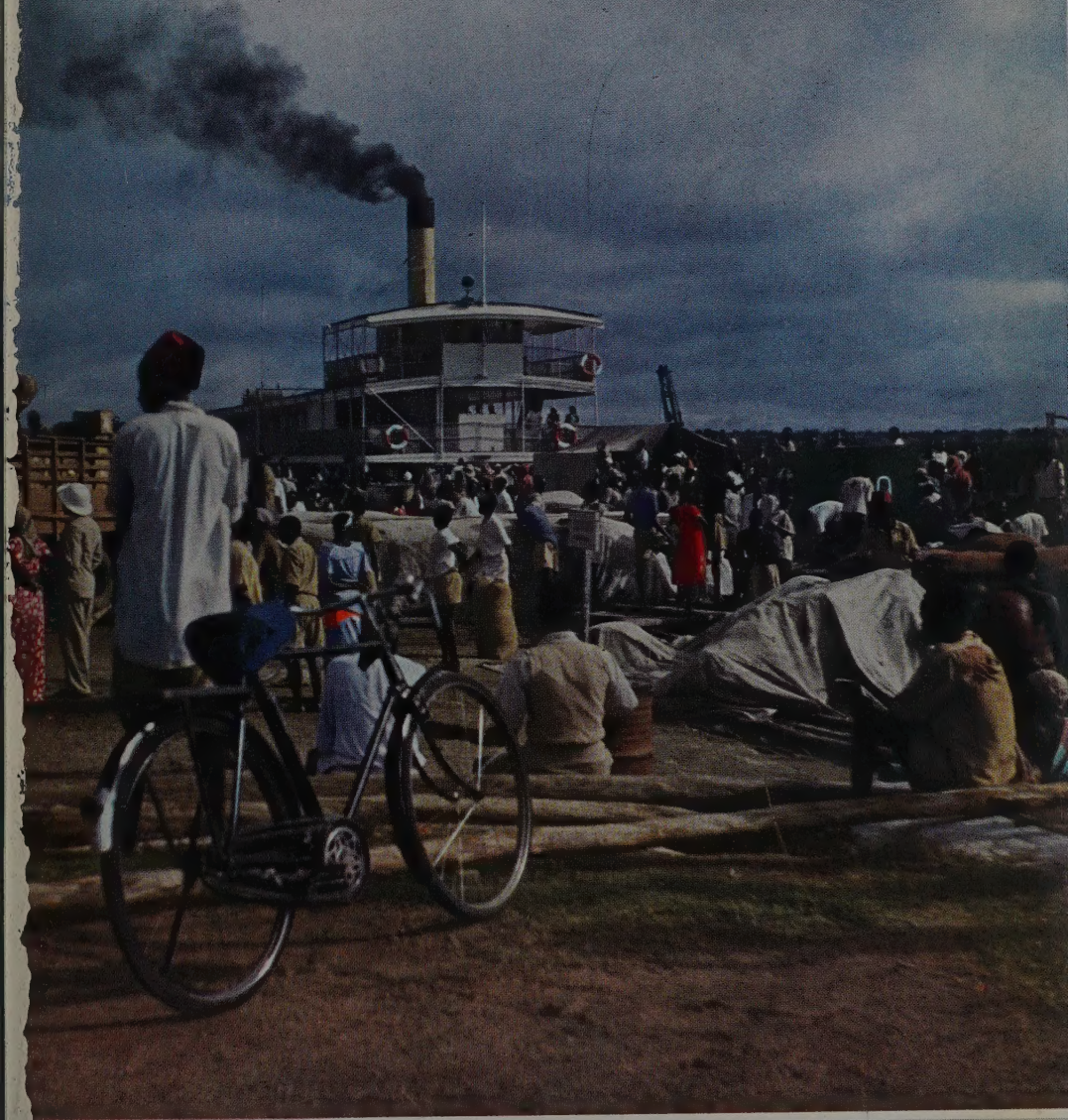


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# GEOGRAPHICAL

## MAGAZINE



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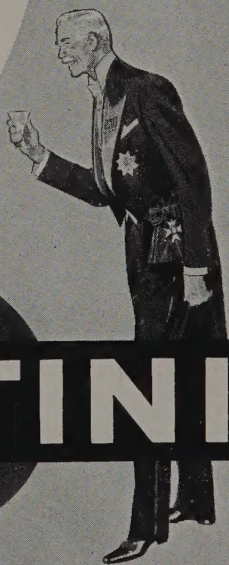
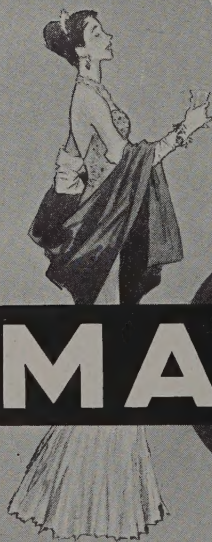
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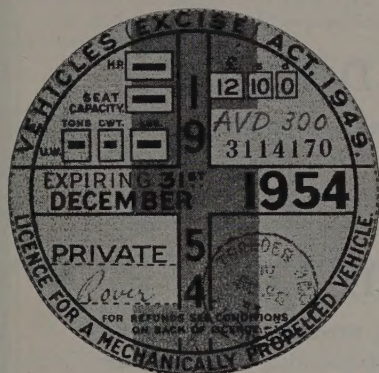
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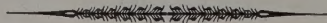


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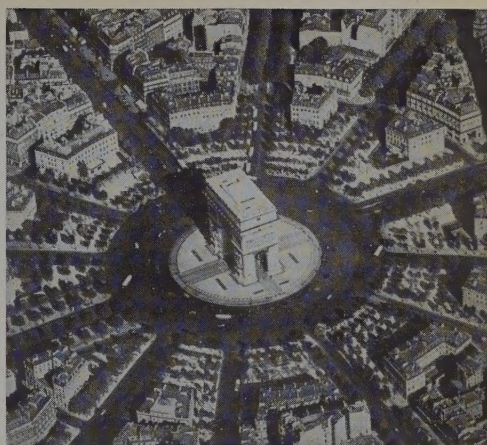
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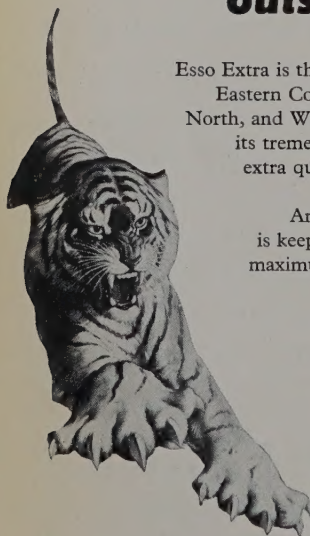
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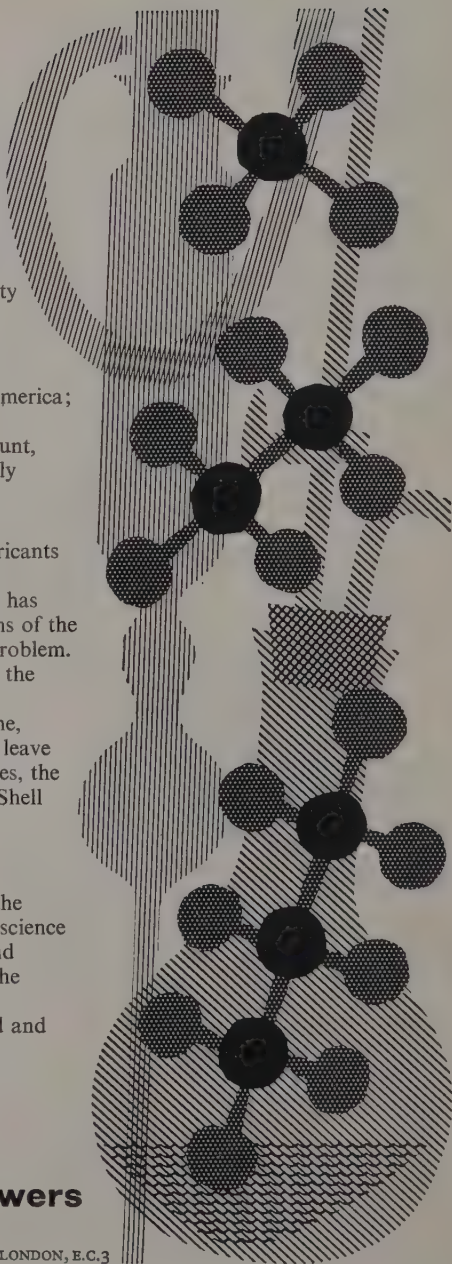
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### CHANGE OF PUBLICATION DATE

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# **YOU CAN'T BEAT**



***THE FINEST PETROL  
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# The White Mountains of Crete

by HUGH FARMAR

*The journey described in the following article depended on another, which was the subject of a recently published book, The Stronghold (Secker and Warburg). Xan Fielding, who served three years with the partisans in German-occupied Crete, revisited in 1952 his wartime friends in the White Mountains, a natural stronghold for the Cretan patriots' resistance to foreign invaders. The book gives a full account of that return—a year's stay—and of the country and its people*

As the aeroplane, still far out above the Aegean, dips towards the hazy coastline of Crete a haggard line of peaks, snow-streaked even in the heat of early summer, rises above the southern horizon. The White Mountains dominate the twisting lanes and the old fortifications and the Venetian houses of Canea, the capital, where the swifts scream above the tawny roofs and round the two minarets which survive from the long Turkish domination. They are the backcloth to the cornfields and silvery olive groves of the plain and the rocky slopes of the tangled foothills.

But, though the mountains are less than a day's journey from Canea, they are scarcely ever visited. Foreigners concentrate on the northern coast and the rather over-restored, over-photographed Knossos and the more beautiful Phaistos with their Minoan remains, the castles and the monasteries. Northern Crete has some good roads and passable hotels. In the south there are no roads to speak of, no inns, let alone hotels, no shops, no sanitation, very little trade. The life of the mountaineers, unchanged by Byzantine, Venetian or Turkish overlords, goes on much as it did in Homeric times. Except that there is no system of clans, the present state of the people of Sfakia, the province which comprises the White Mountains, can fairly be compared with that of the highlanders of Scotland before the Forty-five brought ruin and disintegration to their way of life.

There is another reason for this isolation. Across Sfakia, on a Venetian map of the 17th century which I possess, is written "*Sphakioni populi bellicosi*". In an island noted for the militant qualities of its people, the Sfakians have a reputation which is still regarded with some awe in the rest of Crete. They carry on blood feuds among themselves and indulge in sheep-stealing and smuggling. Many of the men of the families with whom

I stayed had served time in prison for one or more of these offences: the most charming host of all was in retirement while the question of two recent homicides was being resolved.

Yet, with these alarming attributes, the Sfakians combine a strong religious sense and the strictest of moral codes. They maintain, too, the old tradition of open house to the stranger; so that, though according to the regulations I should have had a police-guard in some of the regions through which I travelled, I was never in the slightest danger. The British and Americans are extremely popular. Of magnificent physique, these hill-men are perhaps the handsomest fair-skinned people in the world today, probably the purest surviving descendants of the ancient Greeks. Their courtly manners match their appearance.

As the bus that was carrying me to the mountains progressed, through rocky country of increasing beauty, it was ever rarer for the driver to engage his top gear. The road, never good by English standards, became increasingly rugged, and the stops more frequent.

Sometimes we halted to take on or discharge passengers, at others merely for social reasons; and these pauses, rather than the hills and the execrable road surface, accounted for the indifferent travelling-time of little more than twenty miles in six hours. For Crete, particularly Sfakia, is far removed in time, rather than in space, from the rest of Europe. No-one hurries.

Presently, at a café with a superb view across the foothills to the sea northward, we stopped for luncheon. There were excellent bread and wine and about a month's ration of goat's meat piled on a platter and swimming in oil. The food is often unappetizing, and disastrous to English digestions; and from the

appearance of the meat the animal would seem to have been massacred with an axe and then boiled in oil. There is no attempt at jointing, and roasting, which would appear to be a simple matter over the open wood or charcoal fires, is rarely practised.

The proprietor of the café proved to be a friend of "Aleko", the *nom-de-guerre* by which Xan Fielding, who led the partisans in western Crete during the war, is known. He steadfastly refused all payment and pressed me to stay overnight. It was difficult to disengage myself and to rejoin the bus. This was the first experience of Sfakian hospitality which, however poor the host, disdains all payment. Throughout my journey I was never able to do more than leave a few cigarettes on the table as I left the house.

The bus ground on over roads of yet more broken surface. Often, up a series of corkscrew bends, it had to reverse in order to negotiate the corners. Cretan roads are not fenced and I found this proceeding, with vertiginous drops less than a foot from the wheels spinning among the stones, most alarming. My fellow-passengers, however, paid no attention beyond occasionally getting out to join their directions to the driver with those of the conductor. It was, I thought, fortunate that, throughout the entire journey, we met nothing in the way of traffic except an occasional donkey or mule and its owner.

In the last few miles the olive trees, planes and walnuts gave way to pines and cypresses, the beautiful horizontal cypress which, with the splendid planes, is the chief glory of the surviving primeval forest of Crete which we

were now approaching. Although the ground is often terraced for agriculture, it is so broken that man's handiwork is scarcely perceptible. It is a country of tumbled boulders, streams of crystal clearness and rocky outcrops. With its ancient trees, great stretches of rock-strewn ground interspersed with a *maquis* of cistus and thyme, the landscape is on such a grand scale as to render the sparse villages insignificant. One could smell the keen mountain air.

At length, at the village of Kambanos, we reached the end of the road. Aleko's name had its usual magical effect and I was welcomed at the café by the Mayor, the parish priest in his black flower-pot hat and the local doctor who, in contrast to the rest, wore a suit of townish cut. Surrounded by what appeared to be the entire population of the village, which nevertheless refrained from intruding too closely, we four celebrated my arrival at a small round table in the middle of the street. It was difficult to resist repeated offers of hospitality for the night, impossible not to accept renewed draughts of potent raki. At last I was hoisted on to a jennet with one of the crimson saddle-cloths which are woven in the villages and led off by a shockheaded boy on the last stage of my journey.

Evening, the swift dusk of the south, was falling as we set out through the scant pine trees with tall black-eyed delphiniums growing beneath them at the borders of the village. As soon as we left the road it was as if we were travelling through a titanic rock-garden of surpassing beauty.

Here were gorges, hanging cliffs of grey and ochre rock interspersed with gnarled old pines, cypresses and an occasional olive tree. At one point an enormous plane—and unless one has seen that tree in its own country one cannot appreciate its magnificence—overhung a glen through which rushed a torrent. The banks of the glen were thick with great bushes of oleander covered with their large bright pink flowers and, nearby, a steep place was deep in tall violet sage.

In this enchanted glen with the evening sunlight glowing through the pale green leaves of the plane and the background of snow-capped peaks, I forgot the combined effects of my recent celebration and the alarming sensations induced by the efforts of the jennet as it scrambled and slid up and down a path resembling a staircase wrecked by an earthquake.

Koustoyerako, the village for which I was bound, stands on a shoulder of the hills. Here lives a famous family of partisans of the last war, the Paterakis, friends of Aleko from



A. J. Thornton



whom I bore a letter to them. It was Manoli Paterakis who, when the Germans, in reprisal for guerilla activities, lined up the women and children of the village in front of the church preparatory to shooting them, crept up and picked off the commanding officer before he could give the order to fire, and threw the rest of the gang into panic. It was he, too, who helped Patrick Leigh-Fermor, who commanded the partisans in eastern Crete, to kidnap the German Commander-in-Chief and take him prisoner by submarine to Egypt. And his brothers have almost as many exploits to their credit.

This family, as if the unexpected arrival of a non-Greek-speaking Englishman were an everyday event; received me with the utmost kindness and, in response to Aleko's note, Kosti dropped whatever he was doing, and accompanied me for the next four days across the mountains.

Village houses in the mountains are of the utmost simplicity, consisting of one mud-floored room at ground level and one, occasionally two, above. The food is very plain: bread, cheese, wine, a tea made from mountain herbs, sometimes eggs or meat. There is very little furniture, probably less than in pre-war days because, although the men remained unconquered in the hills, the Germans sacked and burned many of the villages. The bedroom contained four beds, five rifles, a Tommy-gun and two or three wooden boxes. A swallow had its nest under a beam and chirruped sleepily as the lights, one lamp with a globe and two oil dips hanging on chains of the same pattern as the ancient Greek lamps, were brought in. As, in Manoli's bed, I stretched myself out to sleep, a sweet chorus of sheep- and goat-bells came from the folds below. Through the open wooden shutter (for the village houses have no windows) I could see the fantastically brilliant constellations swinging above the peaks of the mountains I so long had wished to visit. After a long day of travel I was so tired that I soon went to sleep though conscious that the Sfakian fleas were apparently immune to the effects of the insect powder I had sprinkled around me.



*Hugh L.*

*The older men of Crete wear black head-scarves, baggy breeches and long boots and carry peculiar twisted walking-sticks cut from trees that grow on the plain of Omalos*

At about five o'clock next morning I was awakened by a large cockroach landing upon my face. I must have shown my disgust forcibly because the three Paterakis in the other beds all burst out laughing. After a brief breakfast Kosti and I set out on our way up the mountains. As we were starting, a baggy-trousered man and a boy with a donkey loaded with a variety of sacks and kitchen utensils joined us and relieved me of my rucksack. The way led up a stony ravine through increasingly wooded ground. I thought the going steep and hard; but it was nothing to what I was to experience later.

The stillness in the gorge and the echoes of our voices were almost uncanny. A cuckoo's call sounded and re-echoed until it became a

chorus. The blackbird's song, so familiar in neat English gardens and trim hedgerows, achieved a fresh loveliness in these wild surroundings. Presently the trees thinned, and we were among rocks interspersed with thickets of yellow berberis and many low-growing shrublets. Some of these looked inviting seats to my now weary limbs; but nearly every stone in Crete is pointed and every bush covered with spines. At length, after a climb of four hours, which Kosti told me he usually achieved in one, we were at the shepherds' bothy at over 5000 feet with the towering peaks of the mountains above us and the great ravines which divide them at our sides. Here, on the saddle of Crete, the views in every direction were staggering. Below us lay the curious plain of Omalo. Northward

the two capes of western Crete stretched like fingers into the sea beyond Canea and the famous anchorage of Suda Bay. To the south one could again look down to the sea along a bare ravine past a huge cone to the island of Gavdos in the distance. Nearby towered the savage snow-streaked peaks and the grey- and pink-caverned cliffs, the "Untrodden", crags and precipices of such steepness and crumbling surface that only the Cretan wild goat, the *agrimi*, can scale them.

The wild goats, splendid beasts with rugged back-sweeping horns, though sorely persecuted, have their last stronghold here. In spite of much scrambling and spying we did not succeed in seeing one. But there were other noble creatures about. Suddenly there swept over a brow a great bird—a second, and

*High above the plain of Omalo are the mitata or shepherds' bothies occupied by men of brigandish appearance who spend the summer tending the sheep and goats, milking them and making cheeses*

Hugh Farmer







*Daphne Fielding*

*Sheep and goats are separated and penned into different enclosures. Two men stationed at the entrance catch and milk them with incredible speed into a cauldron, then they are released again*

then seven more, until the sky was full of the wheeling shapes of griffon vultures.

The griffon, with its immense spread of wing and light-coloured mantle contrasting with its dark body, is an extremely impressive bird which accords with the savage majesty of these mountain-tops. But I hoped, too, to see a bird much rarer and even more remarkable; and presently I was rewarded. Across a ravine swept an enormous dark-grey bird with long narrow wings and a wedge-shaped tail.

The lammergeyer or bearded vulture, the

largest European bird of prey, has to be seen to be believed. It may have a wing-spread of over nine feet. Unlike the vultures, it flies with elongated neck; so that the impression is of a flying dragon rather than of a bird. The lammergeyers that I saw were too far away for me to be able to distinguish the red eye and the beard which are the other peculiar features of this extraordinary creature, neither vulture nor eagle, which scorns carrion meat and which has the strange habit of dropping bones from a height onto the rocks to enable



it to secure the marrows. Though a few may still survive in Spain, Crete is almost the last place in Europe where it is found.

Golden eagles, the red-billed croucher with tumbling flight and echoing voice and the big alpine swift also haunt these heights; and I found alpine accentors, like English hedge-sparrows with rosy underparts, crag martins and the great white-bellied swift whose speed may be the greatest of all birds. Kosti presently disappeared with a gun in search of partridges which could be heard chuckoring among the rocks.

These highlands have a flora all their own which has fascinated the few botanists who have explored them. There were purple-striped crocuses with golden throats, scillas growing where the snow had just melted, round cushions of spines from among which thrust out white and violet pea-like flowers and the rosettes of a dwarf gromwell (*Lithospermum caespitosa*) with white-eyed flowers of a brilliant gentian blue. The next day, scrambling up a very rough place, I slipped and fell heavily. As I got up, I noticed a tiny flower among the stones and, after a brief search, was able to collect, for the third time only in this century, bulbs of the immensely rare Cretan tulip. My finding it was a pure accident. It is a minute thing, its chalice creamy white within, the outside of the petals a rosy maroon.

The place at which we had halted is called Akhlana, a shepherd's bothy which is only occupied in summer. The men, of whom there were eight at the time of my visit, sleep in stone huts vaulted or roofed with timber and furze next to folds into which the sheep and goats are driven at sunset. These huts, or *mitata*, are built exactly as those described in Homer and, except that the men go armed with rifles and revolvers instead of spears and bows, the life lived in and around them cannot have changed since those days.

Accustomed though I was to the fine appearance of many Cretans, the superb physique of these shepherds was most striking. With the exception of a boy whose brigandish appearance was enhanced by a revolver strapped to his hip, they all stood over six feet and were more than broad in proportion. Several were notably handsome: all had magnificent teeth, due no doubt to their diet of brown bread, milk and cheese. Most of these men, of the younger generation, wore army-type breeches instead of the traditional baggy trousers.

Soon after we had arrived they began to come in with their flocks for the milking until there were eight shepherds and eleven dogs.

But long before we saw them we could hear the shepherds calling to each other across the hills and presently we could hear the melody of the bells as the flocks approached.

It was interesting to see the Biblical separation of the sheep from the goats into different folds. Once inside, two men stay at the entrance, where a huge cauldron for the milk has been placed, and each catch and milk a beast as it comes forward. The milker clamps the animal between his thighs, facing towards the beast's tail. The average milking time was incredibly quick, about twenty seconds. As soon as one animal is milked, it is released and another seized. Later comes the long process of separating the cream and the making of the cheese which continues late into the night. Finally the cheeses, the main commodity sent to the towns, are stored to mature in cool chambers underground.

A *mitata* is not luxurious; and my stay at Akhlana was far from comfortable. At supper I had a dish to myself; the five others in the hut ate out of a communal bowl. By the flickering light of a resinous fire their wild hair, half-grown beards and head-scarves gave the place the appearance of one of those 18th-century pictures of banditti in their lairs which our ancestors were fond of bringing back from Italy.

My bed, part wood and part stone, was so hard and knobby that it was not until next morning that I noticed that I had been lying on a bandolier. I was glad to rise and, feeling somewhat better, to explore with Kosti and his dog Stalin the precipitous gullies and slopes around us. Next day we set off at five in the morning up some rough gullies, over snowdrifts and scree, on the long walk over a shoulder of the mountains and down the Gorge of Samaria.

The descent of the gorge, the largest and most magnificent in an island of ravines, cannot fail to be one of the great experiences of a lifetime. Words are inadequate to do justice to the scenery, the terrifying descents and the feeling of awe which the immense cliffs and dizzy heights inspire. The Grand Canyon of Colorado is so vast that it is impossible to find any criterion by which to judge it. The Gorge of Samaria is tremendous without being completely overwhelming. It is romantically wild and savagely beautiful, beyond the dreams of Salvator Rosa. All the 18th-century adjectives descriptive of scenery—awful, sublime and terrible—spring to one's mind as one tries to describe it.

Perhaps the entrance to the gorge at the end of the path leading from Omalo or, as



*The Gorge of Samaria, leading from Omalo to Ayia Roumeli on the coast, narrows at "the Gates" to a cleft only twenty feet wide between towering cliffs: a ravine of savagely terrifying beauty*

*Daphne Field*

we approached it, from over a shoulder provides the most dramatic moment of the journey. One comes upon it suddenly round a corner of the rocks. The impact is terrific: there, after miles of rock, maquis and occasional trees, are huge gnarled and twisted cypresses clinging crazily to the mountain-side and beyond, across the great void of the

gorge, the snow-capped peaks and precipices of the "Untrodden". No place that I have seen so well lives up to its history of inaccessibility, the very shrine of the Cretan spirit where, during the long Turkish domination, the proscribed Christian religion was still practised and the conquerors never succeeded in controlling.

The descent into the gorge is not for the squeamish. It is painfully steep, and the frequent landslides make the depths beside the track seem more alarming. For hours one zig-zags down this track with fresh views of the great sheer 3000-foot cliffs, splendid trees and soaring peaks at every turn. We lunched under a plane by a spring, and presently we reached the floor of the gorge where an icy torrent rushes between gigantic boulders. Further on, where there are immense cypress trees—the largest in Crete—and an ancient chapel, we stopped to talk to an old man and his son who live in summer in a dwelling, half hut, half cave. At length, along a path beside the torrent where were growing the white Cretan peony and cyclamen, we reached the group of houses which form the village of Samaria. "I smell meat!" cried Kosti. The people of the hamlet are notable sheep-stealers.

Kosti seemed reluctant to stop; but I was very tired, and soon, after a parley across the stream, we were invited to the nearest house. After greetings from the family I went to lie down on some fairly level ground. Presently I was summoned to a meal, a strange but welcome collation consisting of an excellent rice pudding followed—between two of us—by fourteen hot hard-boiled eggs. Famished as we were, we consumed everything put before us.

Samaria is probably the remotest village in Crete, sometimes cut off by the height of the stream, approachable at best only on foot; for often mules or donkeys cannot manage the passage of the gorge. The life of the people must be extremely hard since there is no ground fit for crops, and only a few olive trees. Shut in by the crags, it must be a lonely place in winter. But the family seemed happy and healthy with the exception of one boy who showed evidence of malaria.

The grandmother continually plied her distaff. She was weaving on a loom a fine red-and-black saddle-cloth, the colours derived from natural dyes. The eldest son was a young man of extraordinary breadth of chest and of great strength which, I gathered, stood him in good stead in hunting the wild goats in the cliffs of his home; perhaps, too, in bringing back sheep from forays over the mountains. Soon, after I had rested, we started again on our way.

Evening was now falling as we approached the last stage of our journey. As we went on the cliffs, a mile or more apart for most of the descent, closed almost threateningly on either side. We continually had to jump over or ford the stream; the daylight was a thin

strip high above the enclosing walls. When a shower of stones, dislodged perhaps by a wild goat a thousand feet above, bounded down the cliffs Kosti quickly pulled me out of danger under an overhanging rock. At its narrowest the gorge is less than twenty feet wide while the cliffs are perhaps 1500 feet high. At length, after losing count of the number of times we had forded the stream, we left the eeriness of the Gates, as they are called, behind and arrived at the village of Ayia Roumeli. One side of the gorge was already in darkness: the other was stained rose and crimson by the setting sun which caught, too, in a brilliant light an old Venetian fort high up above the village. Beyond the houses, through thickets of oleander, lay the sea. Lights were already twinkling from the houses set in among mulberry and fig trees. In contrast to the crocuses and tulips of the snow-line that we had left that morning, fireflies and the white bells of a datura lent it a tropical air.

At Ayia Roumeli there was a bowl of sweet black mulberries and cream for supper and our hosts abandoned their bed in favour of Kosti and me. After the long rough walk of over twenty miles I was tired and even Kosti's habit of grinding his teeth and muttering in his sleep, perhaps dreaming of the encounters he had had with the Germans in the country we had passed through that day, was scarcely able to disturb me. Our host slept on a sort of couch against the wall. His wife slept on the floor.

Ayia Roumeli is an attractive village. There is a confusion of watercourses and twisting alleys among which, although there cannot be more than thirty houses, I soon lost my way next day. It was not until I was about to be passed on to a fifth double round of raki that Kosti rescued me.

Even among so courtly a people as the Cretans, the people of this village seemed to have outstandingly beautiful manners. A woman met casually in the road handed me the flower she was carrying with a natural grace. I was constantly embarrassed by people, often old, giving up their chairs to me; and on one occasion I found that a family of six were waiting to start their meal until I had finished writing up my notebook.

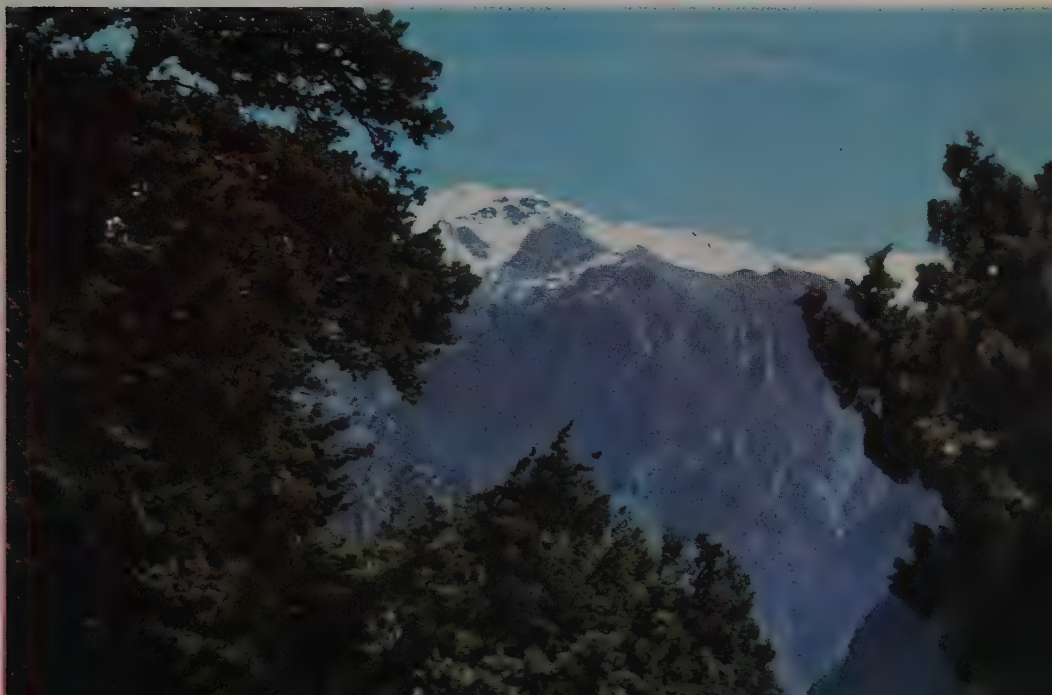
Again, I was struck by the extraordinary beauty of these villagers. The sister-in-law of my hostess, in her black coif and dandling a laughing child, might have sat as the Madonna for Raphael. And, down by the shore, the old man in charge of the single telephone line to the village of Sfakia along the coast





Kodachromes by George V.

(Above) *The plain of Omalo, a fertile tableland over 3000 feet up in the desolate limestone of the White Mountains; potatoes are cultivated there when the snows have gone. (Below) The peaks of the White Mountains rise beyond the head of the Gorge of Samaria, above the remnants of the cypress forest*





*(Above) Cretan mountain villages are seldom beautiful in themselves, but they perch superbly among the high valleys. Here visitors with the right credentials are warmly welcomed, in contrast to the reception that traditionally awaits a foe. (Below) Wild anemones at the edge of an olive grove*







*Daphne Fielding*

*Lutro typifies the south coast of Crete, with its Turkish fort and semicircle of old Venetian houses on a beach rising steeply to the mountains where foreign rulers have never long held sway*

could have served as a model to Rembrandt.

Telephoning to Sfakia, where I was expecting Aleko to join me, was a ceremony. First the old man hurried to a cupboard and charged three glasses with raki. Next, apparently out of the same bottle, he refreshed two accumulators formed out of large jam jars: finally he whirled the handle of the antiquated machine and—it seemed to his intense surprise—received an immediate reply. My stay at Ayia Roumeli while awaiting the caique which was to take me to Sfakia was most enjoyable; exploring the lower end of the gorge by daylight, scrambling up the hillside, circumspectly bathing in the surf of the little semi-circular, deep blue bay or simply lazing at the café by the shore under an old mulberry tree among oleander bushes in a frenzy of pink blossom.

The café was a great meeting-place for the men, and no-one seemed to have very much to do except gossip and play cards. The younger of the two gendarmes from the post next door came to look on and the captain arrived back from an unsuccessful shooting expedition.

The captain of the gendarmes showed me over his post. He was an Athenian and clearly

felt an exile. But he was the proud possessor of a wireless set and succeeded in tuning in to a British station. What seemed to be a recital of North Country folk-songs sounded rather bizarre among the oleanders, looking out across the surf towards Libya; and the programme was a good deal interrupted by some Arabic singing from Cairo.

I left Ayia Roumeli with regret and soon, in company with an unfortunate goat which lay trussed on the floorboards of the caique, we were chugging along the coast.

From the sea the White Mountains are even more impressive than when one is in their midst. Never, except in the Faeroe Islands, have I seen such cliffs. An occasional tiny village, a group of trees dwarfed by distance, add point to the vast scale of the pink, grey and ochre precipices. Some convulsion of Nature has uptilted the whole western end of Crete; and the ancient tide-marks still show, twenty feet above sea level.

Presently we passed Lutro, a semicircle of old Venetian houses round a still, blue bay; and soon afterwards rounded a headland and reached Sfakia where Aleko met me. From there we began together a journey across the island of which he has told in his book.



# Isaka Goes South

## A story of change in Uganda

by JOHN MIDDLETON



*Ektachromes by the author*

*Last year's Oxford University Expedition to Uganda spent three months studying land use and the economy of rural communities in the far north-west of the Protectorate. It comprised a botanist, a soil chemist and a geographer as well as the author, a social anthropologist, who describes some aspects of the general background which must be taken into account in the work of such expeditions*

It is often said, by well-meaning but muddled persons, that if only we would leave the colonial peoples, especially those in Africa, alone all would be well with them. It is thought that they would be more content if the evils (and with them presumably the benefits) which have come to them as a result of European rule were removed. This is merely to say that to remove the symptoms cures the disease. Once we have brought colonial peoples into the economic and political orbit of our Western society we can no longer stop the processes of social change that follow from our impact. But this is not to say that we should be satisfied to sit back and let events take their own course, find their own equilibrium. The nature of change can be influenced by our activity, and there are plenty of actions, both

short- and long-term, that we should take in the colonial sphere.

One difficulty is that only too often we are frustrated by ignorance of what is actually taking place, however good our intentions may be. In Africa today, for example, one aspect of the general change occurring is urbanization, the drift from rural to urban areas. We are still ignorant of many of the social problems involved, of what the process means to the human beings caught up in it, especially those in the rural areas, which may well be impoverished by unbalanced movements of population. It is paradoxical that we spend millions on technical research but almost nothing on finding out what is happening to the people who must manipulate the technical discoveries which we give them.

Yet these may be wasted and misused without more knowledge of the effects they are likely to have on those societies which we like to think of as "undeveloped".

These changes affect individuals. Africans, like anyone else, are not mere cyphers. "Peasant farmers", "labour migrants" and all the other categories which we use so freely consist of individual people, who differ from one to the other and from one society to another—and there are many hundreds of societies in Africa, each with its own language and culture. All too rarely do we think of change and development in terms of what they mean to the individuals involved in them. We must try to see these things with their eyes, since it is only in this way that we can see their true significance.

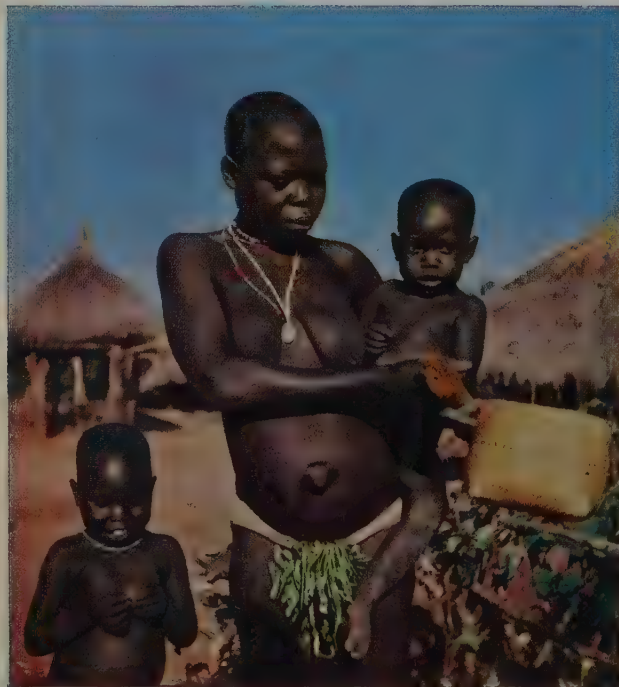
One such individual is my friend Okwaya, who lives in a small clan group in the centre of his tribe's country, in a remote part of north-western Uganda. His people, the Lug-

bara, live on the high watershed between the Nile and Congo rivers, in what is now the West Nile District of Uganda and in the adjacent part of the Belgian Congo. They are split into two by a socially absurd and arbitrary boundary. The country consists of open and almost treeless plains, but is well-watered and fertile. In the centre of the country rise up two mountains, on whose summits are the graves of the two heroes who long ago led their people to their present land, according to local tradition. From them are sprung all the Lugbara, some quarter of a million souls. The mountains are visible from every part of their land, a constant reminder of tribal tradition and of their uniqueness in the centre of their world. Lugbara say that their country is the finest on earth, one in which their ancestors have lived and are buried beneath their homesteads, one of which every part is the subject of myth or legend. They do not wish to leave it for the

*The Lugbara people of Uganda inhabit the high watershed lying between the Nile and the Congo. (Opposite) A Lugbara woman gathering up millet: grain is spread out on granite outcrops to dry. (Below) A homestead by the road to Rhino Camp. The thatched mud-and-wattle huts housing a whole family are contained in a compound surrounded by a thorn hedge which also keeps in the livestock*

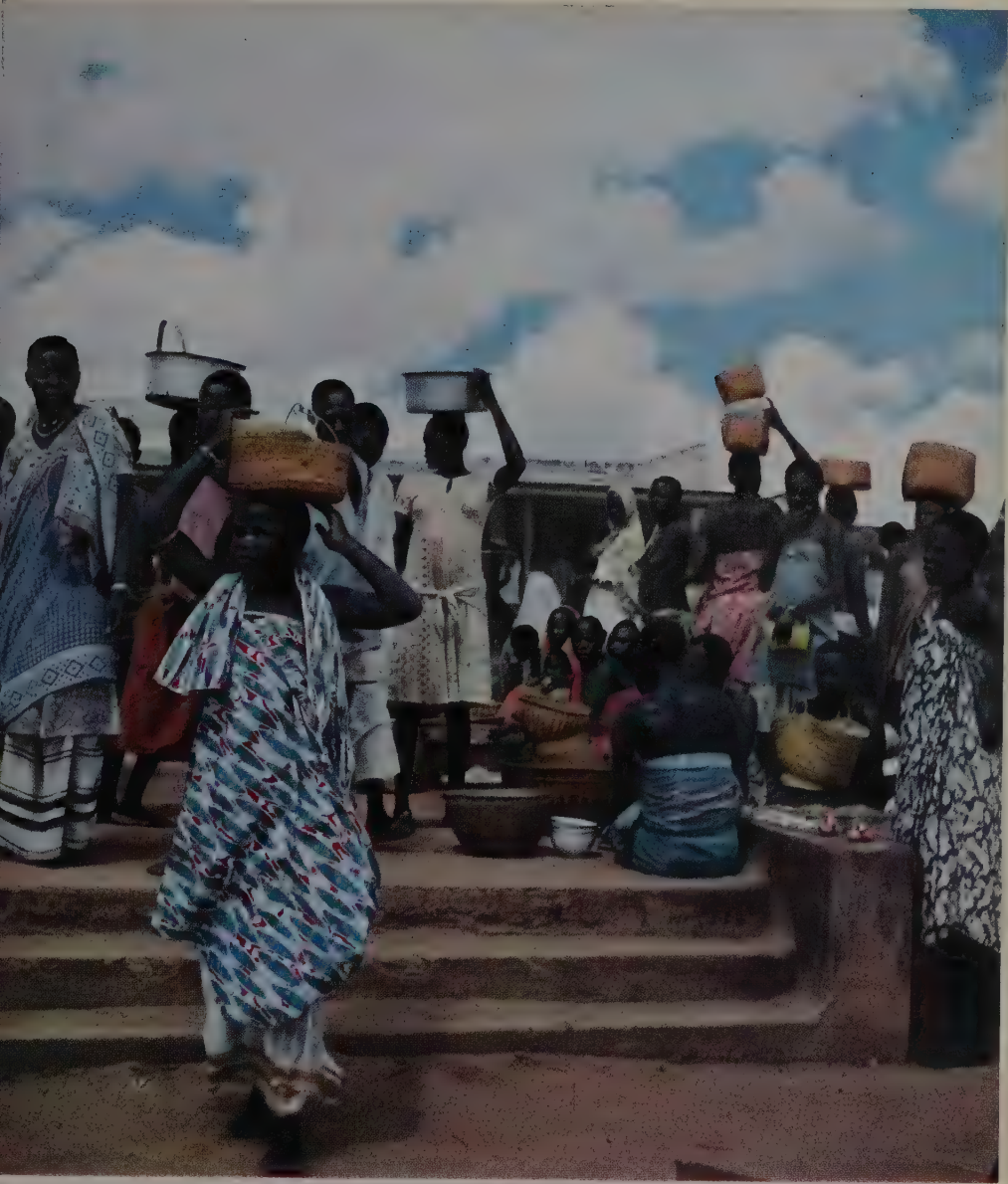






Young Lugbara men are obliged to work in southern Uganda to get enough money to marry and to buy the goods they see in local markets; in addition they find irksome the tribal duties imposed on them if they stay at home. One of these is the making of granaries for reserves of grain to be used in time of famine. (Above) A group of Lugbara making the thatched 'umbrellas' for covering these granaries, which are in the charge of the sub-chiefs: every family must provide not only the labour for making them, but also the grain to fill them. Whilst the young men are absent the women, children and old men are left to carry on as best they can: tribal and family life are disrupted and the whole society tends to disintegrate. (Left) A Lugbara woman and her children. The tattoo markings on her forehead relate to her tribe while those on her body are simply for decoration





*In the markets of such townships as Arua is to be found the merchandise for which the young men need money that they can only obtain by working on the sugar and cotton plantations of the South. Since Arua is near the Sudan border a variety of races, including Lugbara and 'Nubian' Moslems who wear long flowing 'togas' with striped hems, mingle in its only street*



*(Above) At Rhino Camp the Lugbara can take the stern-wheel paddle steamer Lugard, which plies fortnightly up and down the Albert Nile. This is their only means of transport to the South and employment. (Below) Kampala's slums represent for them the glitter of urban life—and wealth*







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*The wealth is relative. After eight months on a sugar plantation the Lugbara migrant may go home with perhaps £3 or £4. But if he works for Baganda cotton-farmers he may—by serving longer and in harder but often more congenial conditions—accumulate as much as £10, the price of a bicycle*

countries of other tribes, in which they are mere strangers, but to till it, live on it and hand it down to their descendants who will remember and honour them when in their turn they are placed beneath their compounds. Lugbara love their country and do not lightly move away from it. And truly it is a delightful region, fertile, green and cool, and remote from the outside world.

Okwaya has never been more than ten miles or so from the hut in which he was born—he is now about sixty. He has lived in several homesteads during his life, as infant, child, youth and married man, but they have all been in the territory of his clan and never more than a few hundred yards from one another. He has never had reason to move far, since his fertile fields have been adequate for his subsistence. His attachment to his clan's land is strong and all-embracing. For him the past, "before the Europeans came and spoiled our land", was happy. People engaged in feuds with their neighbours, sacrificed to their ancestors, tilled their fields of millet and sorghum, herded their cattle and were content. Death from continual warfare, disease

and the recurrent famines of the past are all half-forgotten in a hazy remembrance of a time that has gone, a time in which Lugbara still lived the life their ancestors had bequeathed to them, without being ruled by Europeans who demand taxes and have stopped the feuds. Today people need money, and there are government-appointed chiefs who interfere in many ways with Okwaya's everyday life. He sees the present only in terms of the past, and wants little more than to be left in peace to sacrifice to his ancestors, drink beer and talk with the other old men with whom he has spent his entire life.

Okwaya has two wives still alive, and four adult sons. His daughters are all married to men of other clans: they live a few miles away, and visit him regularly. His sons live in homesteads a few yards from that of their father, and accept his domestic authority: he is nearer to the ancestors than they are and so it is thought right that they should obey him. But they do not see their world in the same way as he does. During their lives people have always used money and paid taxes, and there have always been Europeans and government





A. J. Thornton

chiefs, even though they may be socially remote and to be feared. They remember neither feuds nor famines. The brothers want to marry but have not the necessary livestock—at least five cattle, as well as goats and arrows, are needed to give as bridewealth at marriage. They must each pay poll tax of 18s. a year, and they see in the markets and tiny shops in the local township articles which they want for themselves and for their girls—cigarettes, matches, kerosene, cloth, salt, soap and all the other miscellaneous goods put on display. They are tired of what seems to them the unnecessary work, which they are made to do by their chiefs, of clearing sleeping-sickness belts along the rivers, of weeding their famine crops of cassava, of making granaries for the communal famine reserves, and of carrying the chiefs' boxes and paraphernalia whenever they go on tour to try cases. The brothers, led by Isaka, the eldest, see these tasks as burdens; they do not understand the necessity for communal labour. People forget sleeping-sickness and famine after a few years without them, and forget that before chiefs settled cases peacefully, if not always amicably, the only way to end disputes was to fight with spear and arrows.

Since the early 1920s the prosperity of Uganda, and in particular that of the Province of Buganda in the south of the country, has been based on the growing of cotton, coffee and other crops by African peasants. But the Lugbara plateau is too high and cold for cotton, and although it can grow tobacco for

which there is always a market, there is neither enough land to spare for cash crops nor are Lugbara patient enough to do all the tedious work of growing this delicate crop. They are a proud and independent people and resent taking orders from Agricultural Department assistants—who are usually members of other tribes—about the growing of their own tobacco. Isaka and his brothers need money, for their own taxes and that of their father, and to buy cattle and to satisfy other wants that require cash. They know that although their own country is economically poor they can go outside their own District to richer areas in south Uganda and can earn money there. Not a lot, perhaps, but it is more than they can get at home. And what is more, outside their District they

are beyond the authority of their chiefs and need do no communal labour.

During the period of rapid economic expansion in south Uganda, in the mid-1920s, there came the first calls for temporary unskilled labour from the railway and the Indian and European plantations—few of the latter have survived. Since then there have been Indian recruiting agents in West Nile District, which with the Belgian Congo supplies most of the labour to the southern areas. Today the largest employers are the Indian sugar plantations near Jinja, at the source of the Nile. Their recruiter is ready to transport Isaka from his home to the District headquarters, where he is medically examined and attested before a magistrate, and then to Rhino Camp or Pakwach, the ports on the Nile. He gives him a ticket for the steamer journeys up the Albert Nile and across Lake Albert, and thence by road, more stern-wheeler and rail to the sugar estates. In Buganda and other parts of the south there is work, cotton and wealth, but it is 500 miles from Isaka's home, and he cannot afford the journey on his own: it is easier to become a labour recruit. If he had some money he would go south independently, working his way by slow stages. In the south he could work for Baganda landlords, or rent a plot of land on which to grow a patch of cotton. There are many such independent migrants who cluster together in settlements of Lugbara set in the midst of Baganda farms. They are known derisively as Bakanabulo, millet-eaters,

by the scornful plantain-eating Baganda, and have a bad reputation for drunkenness and quarrelsomeness, but are strong and hard workers. They, with the many thousands of immigrants from the Belgian territory of Ruanda-Urundi, form the lowest class of poor tenant-farmers and labourers in the wealthy cotton areas of Buganda. They often stay for a year or more, and may indeed settle down with local women and become "lost" men. But all those whom I have ever visited in the south say that one day they will return to their homes, of which they always consider themselves still to be members. There are comparatively few women who go south, and they are usually wives of settled migrants and return home to bear their children at their husbands' natal homes.

After eight months or so Isaka returns home again with his earnings. Like most labourers who sign on at the sugar plantations he brings back a little over £3 and a few pieces of cloth. Other migrants earn enough to buy blankets or even bicycles, the desire of

all young men's hearts, but these rarely work for the Indians. His earnings do not go far and are soon spent, on bridewealth, taxes and, of course, beer-drinking and buying presents for friends, to mark his homecoming.

A year later he returns to the south, this time with one of his younger brothers, for whom he is responsible. The centre of Lugbara, where they live, is densely populated: there are up to 250 persons to a square mile in some parts, a high figure for an African people mainly dependent on subsistence farming. In these parts young men find it impossible to get enough land on which to settle when they are married and have homes of their own, and so they go south to earn a living. There are hundreds of young men who go three or four times, even more, before they finally settle down in middle age, to farm and bring up their children at their paternal homes.

But before Isaka returns he marries a wife, using some of his earnings to help his father find the cattle for his bridewealth. Okwaya

*This elder represents the domestic authority which regulated Lugbara affairs before the Government appointed chiefs and is still respected by his people as the link with their ancestral past. No plans for their future can succeed which fail to take his status and influence into account*



John Middleton

would like to dissuade him from going again, but knows that he must go, to get more money for the family, so that his younger brothers may marry in their turn. The absence of these young men (almost 20 per cent of the adult men) cannot but have a deleterious effect on the social life of their families. For men, married as well as unmarried, to be away upsets the delicate balance of tribal life. Okwaya's home with its young men away becomes unstable and its members discontented. Okwaya is too old to work hard and there will not be enough men to hoe the fields, to build and repair huts and to do other tasks. Religious ceremonies and dances are both of importance in their society, but are poor affairs when men are absent. Okwaya married when about sixteen, but the marriage age for his sons is many years higher, and Lugbara say that sexual immorality and adultery are on the increase. In addition, migrants are beginning to bring back venereal disease, common in the south but hitherto almost unknown in their own country. Lugbara, like most African peoples, are dependent on their kin and neighbours to a far greater extent than are members of European societies. With us the absence of a man may make little difference except to his immediate family, perhaps to none but himself; but in families like Okwaya's his absence affects a wide circle of people directly and in almost every aspect of their lives. I have known many of these people whose sons or husbands were absent. Their refrain is always the same: "Now our land is destroyed, for our men are gone away."

It is often said that men in the rural areas of Africa go away to the towns to satisfy a wanderlust, or because they are fascinated by the glitter and excitement of the urban areas. Certainly as far as Uganda is concerned this is both an exaggeration and a simplification. No-one who has seen and talked with Lugbara in the south—and most of them work there far from any glitter of bright lights, the towns in any case being too expensive for them—would really believe otherwise. Indigenous Lugbara society is beginning to disintegrate: its members see new opportunities for themselves but cannot take full advantage of them if they stay at home. By bringing Lugbara into our economic system, based on money, we have given them new values, also based on money (Lugbara see most European and Christian values in money terms). But we do not give them the chance to realize these values by acquiring money. They say that Europeans have power because of their

wealth and education, so that if only they can have these things they can also have power. To get them they must go elsewhere where they can, even though there they, the lords of the earth in their own land, must live in squalid slums or work as low-paid labourers for other Africans. Lugbara are resentful and say that they are not given a fair chance compared to the other tribes of Uganda.

This is not a happy picture, nor one about which we should be complacent. The Colonial Development and Welfare Schemes, comparatively small though they are, are doing something to provide alternative methods of gaining wealth and education, in its widest sense, for such people as Okwaya and his sons, so that they and their tribes may develop on more hopeful lines than in the past. In Uganda a good deal of effort and money is being spent on community development. West Nile District is perhaps the most remote in the whole Protectorate, but the first enterprise has started, a tobacco factory, built by Lugbara with aid from government officials and the manager of the commercial tobacco factory that has operated in the District for several years. And capital is being provided for other schemes, for which the people cannot provide the money themselves. But this touches only part of the problem. One cannot develop people: they must develop themselves. In some territories, for example, we have tried to force upon the inhabitants a system of local government devised by English local government officers, of which the chief merit seems to be that it has worked well in Bedfordshire or Coventry. This, though well-intentioned, seems hardly adequate.

It is not so simple, of course, to help people to help themselves: they have to be helped in the way they like. Africans must, and can, adapt their own indigenous systems of local government, built up over many centuries, to modern conditions; only thus can the transition be made smoothly and the schemes work efficiently. The Uganda schemes are based on government staff helping the people to carry out their own proposals, rather than spoon-feeding them with our schemes which may not be understood and truly accepted. The difficulty is that so often we are ignorant of the indigenous systems of government in any case, and that time is pressing; we must assist these peoples to integrate themselves into the new society of which they now form a part before all that is most meaningful to them in their own culture is destroyed.



# Oil: Canada's Liquid Wealth

by JAMES PILDITCH

*During the past seven years, Canada's production of oil has increased more than tenfold and she has become one of the world's leading producers. The following article describes the background of this development, which adds to the growing strength of a new power in international affairs*

It is impossible to be in Canada for long without hearing talk of oil. Businessmen on Toronto's stock exchange thumb through the latest oil reports, newsboys on street corners in Montreal shout word of a new discovery. Oil is a symbol of new-found power and prosperity; and the activities of engineers and technicians in the wheatlands of western Canada have excited the public imagination. While all industry is booming, nothing has contributed more to Canada's rapid growth than the discoveries of oil in Alberta.

With a population little more than a quarter of Great Britain's, Canada is the third trading nation of the world, and her dollar is more powerful than that of the U.S.A. She uses more oil *per capita* than any other country except the U.S.A. In the past, most of this oil had to be imported. Only now can her people hope to satisfy their demands with home-produced oil. In 1947 she produced only 9 per cent of the oil she used; now she produces well over half, and it is hoped that by 1955 she will be entirely self-sufficient.

Yet there was a time when oil was a nuisance to Canadians. Near what are now the big industrial cities of Toronto and Hamilton, settlers in the 1850s complained of a "gum oil" on the swamps. They said that it was ruining crops and lowering land values. After a time this strange liquid was investigated and the oil was turned into kerosene for lighting pioneer homesteads. The first well to be opened in Canada was dug at a place in Ontario near Sarnia, then called Black Creek but now known as Oil Springs, in 1858. (This was actually a year before 'Colonel' Drake drilled his famous well at Titusville, Pennsylvania, and inaugurated the modern oil industry.) A few years later, in the same area, a man called Shaw succeeded in going deeper than anyone had before—to 165 feet (today most Canadian wells are between 3000 and 6000 feet deep, while in the U.S.A. oil is actually being produced from below 17,000 feet). Most of the oil he drilled ran away into ditches and gutters, because he had insufficient storage space for it.

Would-be salvagers offered him fifty cents a barrel for it, but he turned them down. Then a man offered him \$25,000 in gold. He refused again. Almost immediately afterwards his well went dry, and he was left without the fortune he had expected. One of the most interesting of the early Canadian fields was at Petrolia, in the same region a few miles south of Lake Huron, where a well was drilled as early as 1865, for this field is still producing small quantities of oil today.

Ontario soon became self-sufficient, and by the 1870s Canadians were exporting small quantities of their oil to Britain. The by-product, petrol, was a dangerous and unsaleable nuisance which was difficult to dispose of, but when the first motor-cars lumbered down the roads of Europe and North America the need for petrol and hence for crude oil grew suddenly urgent, and the search more insistent. Over the passing years, the demand for oil in Canada—as indeed in every other country—has greatly increased.

Then, two months before war was declared in 1914, oil was discovered at Turner Valley in Alberta. This field was to be the scene of almost all of Canada's production for the next thirty years, though actually it was not for another twenty years that the field's main producing level was discovered. Estate agents in Calgary, forty miles north of the Turner Valley field, became oil brokers overnight. Within a matter of days hundreds of oil companies were formed. This was too good to last: by 1915 the war and over-investment had killed the boom. Of the five hundred companies suddenly formed only a few made any attempt to find oil and many investors lost their money. But the Turner Valley field had come to stay. Its entire production during the first seven years was less than that of two days at its peak in 1942, and equal to only a few hours' production from all Canada's oilfields at the present time. But it was bigger than anything seen before, and turned the Canadian oil industry from an adventure into a business. The need for legislation to safeguard the shareholder became obvious, as



courtesy of the Petroleum Information Bureau

*The early days of Canadian oil: the field at Petrolia near Sarnia about 1910. It was brought into production as early as 1865, and still gives a small yield today*

did Canada's need for skilled technicians, geologists and financial experts.

From that time onwards, Alberta became the capital of Canada's oil production. During World War II production was greatly expanded in the Turner Valley field, and new wells were drilled in other parts of Alberta and in New Brunswick. Other interesting developments occurred in the Northwest Territories, where, as far back as 1920, oil had been discovered in the vicinity of Fort Norman on the edge of the Arctic Circle. During the next two decades the field was operated to supply the modest needs of the local population—consisting mainly of miners and trappers. In the war years, however, production was enormously developed at this field, which became the basis of the Canol

project for supplying oil to Whitehorse by a pipeline nearly 600 miles long; there a refinery was erected to meet the needs of the forces stationed in Alaska. With the return of peace, production once more reverted to the level of local demand, while the refinery at Whitehorse was dismantled and transported *en bloc* to Edmonton, where the discovery of new oilfields had stretched the resources of the small Canadian oil industry to the limit.

For in 1947 the Imperial Oil Company (after spending some \$23,000,000 on unsuccessful exploration work) discovered the Leduc oilfield about twenty miles south-west of Edmonton. A year later the Redwater field was found, also in Alberta. These two discoveries had the effect of flinging Canada headlong into another oil boom that has not yet subsided. They far more than compensated for the declining yield at Turner Valley, which had been the major source of Canadian oil for more than thirty years. By 1949, Turner Valley's output was dwarfed by that of the new Leduc-Woodbend oilfield, and this was itself dwarfed by Redwater in the following year. These two fields, assisted by output from other smaller fields likewise discovered since the war, quickly made Canada one of the world's leading producers and, since 1951, the major source of oil within the Commonwealth. Her

production has increased tenfold, from 7,600,000 barrels in 1946 to 61,000,000 barrels in 1952—when Canada was ninth in the list of world oil producers—and in 1953 it increased by a further 30 per cent over the previous year's level.

In the five years that followed the discovery of Redwater, the whole Canadian oil industry has mushroomed. Not only has production boomed, but refinery capacity has been greatly expanded, new pipelines have been laid, and sales organization has been stepped up to cope with rapidly growing internal demand. One of the most welcome signs, showing confidence in Canada's future as a great oil country, is the increase in exploratory activity. Whereas in 1946 there were less than a dozen geophysical teams

operating in Canada, in 1952 the number in the field at one time rose to 185.

All the time the oil industry is faced with four main problems. First the discovery and production of crude oil, secondly its transportation, thirdly its refining—changing it from the unusable crude oil into an immense variety of valuable finished products—fourthly, the final stage, the marketing of these products.

As yet only a fraction of all the possible oil-bearing land in Canada has been covered, but exploration is now proceeding at an unprecedented rate, and large areas have been 'blanketed' by survey teams. Travelling by helicopter, mule train, car, canoe and on foot, geologists are reaching the extremities of the Dominion. Over the muskeg swamps of the Peace River and through the forests of New Brunswick, they go out for several months at a time charting the layers of rock and sand below the earth's surface. With the aid of delicate and costly instruments, they can locate possible oil-bearing formations. Three aids in particular are at their service: gravimeters (measuring minute variations in the force of gravity), seismographs (which record shock-waves thrown back from the subsurface formations) and magnetometers (to determine the magnetic characteristics of the strata). The seismograph is generally thought of as the instrument which measures the force of volcanic disturbances: to use it in the exploration of oil, the geophysicist must cause

an eruption by exploding charges carefully buried in the earth at selected spots. By charting the reflected or refracted sound-waves, he is able to gain an accurate picture of the pattern of the subsurface formations.

All this exploration, and the drilling that follows it, is a gamble. Figures of operations in the U.S.A. illustrate the risks involved: of nearly 7000 "wildcat" wells drilled in one year recently in unproved territory only 3·3 per cent of those drilled without the technical advice of geologists located oil. Even where geologists and geophysicists were consulted only about one borehole in eight struck oil in commercial quantities.

If the geologists and the seismographic survey teams believe that they have found a formation likely to contain oil, the drilling crew moves in. They would use a rotary drill, which bores through the rock in the same way as a dentist's drill pierces a tooth. The familiar derrick—usually a hundred feet or more in height—supports the "drilling string", which consists mainly of a long length of drill pipe with a "bit" or cutting tool on the end. The drill pipe is hollow, and this allows specially prepared drilling mud to be pumped down to lubricate the bit and wash away the rock chipings which are forced up the side of the well as the power-driven bit churns away the rock. The borehole may eventually go down for many thousands of feet—the world's deepest borehole is over 21,000 feet deep—and fresh thirty-foot sections of drill pipe must con-



A. J. Thornton





By courtesy of Imperial Oil Ltd



Nowadays a never-ending and strictly scientific quest for oil takes place from one extremity of Canada to the other; and during the summer months, when the search is at its most intensive, every means of transport is used, including aeroplanes, canoes, motor-boats, horses and helicopters. (Above) Two members of a geological survey team watching a helicopter come in for a landing on a mountain near the eastern Yukon border. (Left) A geological surveyor using a gravimeter—an instrument that measures minute variations in the force of gravity and so indicates oil-retaining strata—in oil survey operations in the Alberta foothills

*By courtesy of Imperial Oil Ltd*

*When geologists suspect the presence of oil, it is time for the drilling crew to begin operations. The derrick supports a long length of drill pipe; while it is rotating, special drilling mud is pumped down the pipe in order to lubricate the bit and wash away the rock chippings which are forced up the side of the well.*

*(Right) A driller at Leduc field holding up a rotary drilling bit.*

*(Below) Adding another length of drill pipe: this must be done every thirty feet. When the bit becomes blunt or sample cores need taking, the whole pipe has to be hauled up. It is at times a very long process, calling for much skill and teamwork*



*By courtesy of Imperial Oil Ltd*



stantly be added. Every time the bit becomes blunted the entire drilling string must be removed and the drill pipe stacked in lengths of about ninety feet. In a deep hole, several hours are needed to change a bit. At intervals, too, the hole must be lined with steel casing, cemented in position, to prevent the sides caving in. Because of all this, drilling is often laborious and expensive—even if there are no complications such as the drill pipe breaking, which will mean ‘fishing’ for the lost piece at the bottom of the hole.

The whole drama of the oil industry centres on the drilling rig and the men who work it. Around the derrick there is an air of excitement and expectancy—an atmosphere that draws adventurous young men across the seas from Britain and other European countries to join with oil men from Canada and the United States. These men cannot tell whether the well they drill will be rich, or

just a useless ‘dry hole’. The days of the ‘gusher’ have passed. Though they were spectacular, oil men found that the uncontrollable oil of the gusher was a danger that had to be overcome. Nowadays, if a well is a success, a narrow tube is connected to the producing zone and the oil is carried, via a system of control valves at the well-head, to storage tanks in the oilfield area.

At this stage the driller hands over the responsibility for the well to the production engineer. He ensures that the oil continues to flow smoothly. The oil is driven up the well by the pressure of the gas and water present, these being removed at the well-head. By returning them to the field, through wells reserved for this purpose, the production engineers can often maintain and even increase the pressure in the oil-producing zone. ‘Repressurizing’ is being carried out at Redwater, among other fields, in order to prolong

*The discovery of the Leduc oilfield in Alberta in 1947 inaugurated the recent Canadian oil boom. The field covers some 22,000 acres; but on the surface one only sees such modest manifestations—*



*By courtesy of the Petroleum Information Bureau*





George Hunter, by courtesy of the Office of the High Commissioner for Canada

*—of the activity provoked in the oil-bearing formations below as derricks scattered among the prairie farmlands and 'christmas trees' (shown in the foreground opposite) to regulate the flow*

its life as a producer. In a few cases in the U.S.A. fields have actually been brought back into production after having been abandoned as uneconomic. Other methods used to stimulate production include "shooting" a well—causing an explosion designed to fracture the rock strata of the oil-producing zone and make it easier for the oil to flow into the well.

Crude oil, in its natural state, is of little use—it must be turned into refined products. But in addition to being refined, it must also be transported. Moving the oil from its source to the market areas where the finished products are needed is one of the biggest problems that has confronted the oil industry in Canada in recent years. The refining centres of Ontario, Sarnia and Clarkson, are some 1700 miles from the source of the crude oil. In order to find a way of supplying Eastern Canada with Western oil, the oil planners had to overcome many problems. They decided to build a pipeline from the well-heads in

Alberta to the Great Lakes. From there, tankers could carry the oil through the lakes to Ontario's refineries. Late in 1950 the pipeline was completed. Well over 1000 miles long, it ran from Edmonton to Superior in Wisconsin (the westernmost port of the Great Lakes), carrying towards Eastern Canada about 60,000 barrels of oil every day or over 20,000,000 barrels a year. Even though it flows constantly, oil pumped into the pipe at Edmonton takes twenty-six days to reach the lakehead.

The Interprovincial pipeline, as it is called, was a major project. Costing \$90,000,000 (some £30,000,000), it involved not only the pipeline itself, but the building of storage tanks at Edmonton and Superior and the erection of loading and dock facilities. Before it was half completed plans were being made for even further development. During the wintry five months of the year all ships on the Great Lakes are icebound, with the result that the original intention to ship oil across

*The Edmonton-Superior pipeline, well over 1000 miles long, was laid in 1949-50 and was taken across the Saskatchewan River in winter: pipes welded together were hauled over the ice and lowered into the river*

courtesy of the Petroleum Information Bureau





*By courtesy of the Agent General for Alberta*

*A further pipeline 700 miles in length to take oil from Edmonton to Vancouver on the Pacific Coast was completed in 1953. Its construction through the Rocky Mountains was a magnificent feat of engineering*



the lakes could only operate successfully during the summer months. For almost half the year the fleets of tankers owned by the various Canadian oil companies were forced to lie idle.

To supply the industrial heart of Canada the whole year round, the Edmonton to Superior pipeline has been pushed on a further 600 miles to Sarnia, through the U.S.A. No sooner had the major problem of moving oil from west to east been settled than the oil men embarked on another project, to carry oil from Alberta westwards to British Columbia. Early in 1952 work began on a pipeline, nearly 700 miles long, from Edmonton to Vancouver. Hacking their way over the Rockies as they laid it, the men followed the footsteps of their pioneer forbears who drove the first railroad through these same mountains. By the autumn of 1953, the work had been completed and oil from Alberta was flowing into storage tanks at Vancouver. It is hoped in this way to supply not only British Columbia, but the western seaboard of the United States as well.

Ultimately, when additional pumping stations have been added, these two major trunk pipelines will each have a daily capacity of about 300,000 barrels, and Canada will have a pipeline system capable of handling well over 200,000,000 barrels of oil in a year; in other words, nearly half as much oil again as Canada is using at present, or enough to meet more than one third of the oil requirements of all Western Europe.

When the projected route of a pipeline has been surveyed from land and air, approval must be obtained from property owners along the route. On the 400-mile line from Toronto to Montreal, for instance, 2900 land-owners had to be consulted before any laying could begin. Then the route is marked with stakes hammered into the ground at 100-yard intervals, before contractors with their ditching machines begin tearing up the earth and the pipelaying crews appear on the scene. The pipe, carefully wrapped to protect it from corrosion, is laid in the trenches and covered over. The construction men are followed along the route by "clean-up gangs", who repair fences, sow crops where they have been trodden underfoot, and generally restore the land to its original condition. The pipeline must be constantly inspected for leaks; sometimes these will be indicated on the gauges at the pumping stations, used to boost the oil along. The pipeline way is also patrolled, on foot or from the air, and any evidence of a leak is immediately reported.

The refineries which are fed by the pipelines look bizarre in the extreme: towers, globes and spirals, built of steel, rise above the rural landscape of Canada. The crude oil which has been found at such cost and labour is turned into the infinite variety of products—such as petrol, gases, waxes, many-coloured oils, and other fascinating derivatives—that have become so essential a part of our life.

Almost from tradition, the oil refineries of Canada have been situated mainly in the East. In Halifax, Montreal, Sarnia and Toronto refineries have grown up since the nation first discovered a need for oil. There are two reasons for this. In the first place the majority of Canada's oil was imported. In the East lie the natural waterways—oil was brought up from the Gulf of Mexico and South America to the St Lawrence River and the Great Lakes, through which it could also travel from the U.S.A. Secondly, the bulk of Canada's industry and population is in Ontario and Quebec. Refineries in the Prairie Provinces refine Alberta's crude oil for local markets, while those in British Columbia, which originally processed American oil, are now partly supplied from Alberta through the new pipeline.

Crude oil, a mixture of hydro-carbon compounds, must be broken down by the refinery into as many marketable products as possible. The basic job, of producing the largest quantity and highest quality of petrol from the crude oil, is now only one of many performed in the refineries.

Fundamentally, the refinery has three main functions. First, it separates the various fractions from the crude oil by distillation. Secondly, it treats the products where necessary to make them ready for marketing. Thirdly, it converts less useful products into useful ones, by rearranging the hydro-carbon molecules. The high-octane fuels used in modern motor-cars and piston-engined aircraft, for instance, are largely the product of this conversion process, of which the best-known instance is "cracking". Thermal cracking—changing the pattern of the molecule by heat and pressure—has been largely superseded by catalytic cracking, in which a catalyst is used to help the reaction. Other processes used to produce high-octane spirit include re-forming and polymerization, which also change the structure of the molecules.

When products of the oil industry are mentioned most of us think first of petrol, kerosene, lubricants, diesel and fuel oils. But there are now hundreds of other products coming



*By courtesy of the Office of the High Commissioner for Canada*

*Crude oil from the wells in Alberta is pumped through pipelines for some 2000 miles to refining centres in Eastern Canada. Here at Sarnia, south of Lake Huron, it is broken down into fuels and lubricants, as well as products that are incorporated in anything from dresses to detergents*

from crude oil, thanks to the newest and fastest-growing branch of the industry—petroleum chemistry. Making chemicals from oil is not very revolutionary in itself. But more synthetic organic chemicals are now made from petroleum than from all other raw materials together; and—if there were uses for all of them—more than half a million compounds could now be synthesized from petroleum. The names of these compounds are familiar only to technicians, but the marketable products obtained from some of them are used by millions. They include products used in the manufacture of plastic containers, detergents which ease the work of the housewife, stylish containers for cosmetics and synthetic fibres which are woven into fabrics and manufactured into garments that are crease-proof, resistant to sun-bleaching, quick-drying and do not need ironing. Some of these synthetic materials have the warmth

and feel of real wool; clothes made from them are already beginning to appear in our shops. Technicians are finding that the possibilities of oil, and the synthetics produced from it, far outstrip all expectation.

The manifestations of the oil industry in Canada are varied: the survey teams moving across the snow in their search for oil, the steel drilling rigs, the men on lonely pumping stations along the pipelines, the storage tanks, the millions of machines using its petrol in town and country, the great refineries and the subsidiary industries to which they are giving rise. Its widespread effect on prosperity, employment and the Dominion's position in the world will become obvious in the course of time. Besides speeding up development in some regions, the discovery of oil in large quantities has done much to show Canadians the unbounded possibilities of their own country.

# Oil Pollution of the Sea

by JAMES CALLAGHAN, M.P.

*The author is Chairman of the Coordinating Advisory Committee on Oil Pollution of the Sea and is one of a small group of people whose activities have been largely responsible for focusing public attention upon its evils during the past few years. They recently met with considerable success in persuading the British Government to call a conference of the principal maritime nations which this month in London is discussing international action for dealing with the problem*

FOR many years now, the onset of the autumn westerly gales from the Atlantic has been followed by pathetic stories of sea-birds washing helplessly about in the cruel seas near our coasts, unable to escape because their wings and bodies are coated with thick, black, greasy oil.

Many birds are fouled with oil far out in the Atlantic. Because they cannot fly, they swim until they can paddle no more and then slowly sink and are drowned. The Danish naturalist, Dr Vedel Tåning, described last year the razorbills and guillemots he had seen far out in the ocean, incapable of flight because their wings were clogged with oil, and so saturated with water that they were gradually drowning and could hold only their heads and necks above the surface. They were doomed to a slow death.

Even those birds which manage to swim safely to shore have no way of freeing themselves from the clogging oil. They drag around on the beaches, and if they do not starve, they freeze to death, for the effect of the oil is to destroy the pocket of natural insulation between the down and the body.

For a long time the naturalists were alone in their protests and only half-hearted action was taken to free the seas from oil. But since the war, the menace has grown worse and families visiting the seaside for their summer holidays have found sand, shingle and rocks covered with viscous black oil that becomes sticky in the hot summer sunshine. Clothes and feet attract patches of oil that prove impossible to get off with soap and water. Some seaside chemists are doing a roaring trade by selling solvents made up to smell fragrantly in fancy bottles—and at fancy prices. My own experience is that a bottle of turpentine and a rag will remove most of the oil. But if the chemists were philosophical, the rest of the seaside community were up in arms. Visitors complained that days on the beach were being made miserable; landladies and hotel proprietors protested about the damage done to carpets and furnishings; and local authorities insisted that they could not afford to employ

armies of men, flame throwers (which were useless because the oil will rarely burn), bulldozers (which only buried it, leaving a gale to wash it free again) and the other devices that were pressed into service to free the beaches of their contamination. And so at last the birds found powerful allies whose object has become to seek the causes of the nuisance and eliminate them.

At first there was dispute about the causes. When I addressed a letter to the *London Times* over two years ago expressing my "strong suspicion" that oil tankers were the main cause of the trouble, I was immediately taken to task by the Chairman of the Oil Tanker Section of the Chamber of Shipping. The Chairman said that I had put forward no supporting evidence and, more important, the Minister of Transport said that he had no evidence that oil tankers were a major cause of pollution. The Minister said that samples of the oil showed that it had been in the sea for some time, and that it might have come from war-time wrecks gradually breaking up on the ocean bed. This official view was not accepted by a small group of people who were troubled about the growing menace to our coasts and wild life and who formed themselves into a voluntary Committee to study the matter.

This Committee focused public attention on the problem by means of letters to the Press, articles in the weekly journals, and Questions in Parliament, and quickly became the spearhead of all interested persons, organizations and local authorities who were pressing for action. The publicity had an effect, and in September 1952 the Minister of Transport appointed an official Committee whose Chairman was Mr P. Faulkner to report on what practical measures could be taken to prevent pollution by oil of the coastal waters of the United Kingdom.

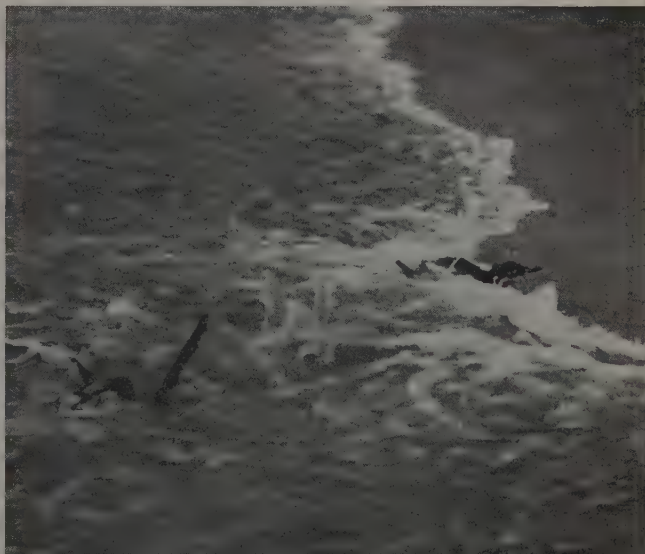
The Faulkner Report, published in July 1953, confirmed the opinions of those who had refused to accept the earlier official view. It said that it was "unlikely that wrecks were responsible for more than a small part of the





Victorial Press

Perhaps the worst sufferers from pollution by oil are the sea-birds. Many are contaminated far out in the Atlantic Ocean, and as the oil prevents them from flying down in slow stages: others, affected nearer land, are washed ashore in a moribund condition, and die of starvation or of cold. (Above) Two R.S.P.C.A. inspectors holding a couple of the victims. During the summer of 1953 these men often worked well into the night on the beaches in an effort to keep up with the veritable flood of oiled birds. The majority of them were destroyed to cut short further suffering. (Right) This is becoming too common a sight: the bodies of the dying sea-birds—razorbills, guillemots and many others—washed pathetically in by the rising tide





Picture Post Library



Since the end of World War II the problem of oil pollution has become much more serious than it was previously, since Britain and other European countries have begun importing oil in its crude state. Thus, after the main cargo has been pumped out there is an unwanted residue which clogs the ship's tanks and must be disposed of. Even if it is discharged far from the European Atlantic seaboard the general easterly drift will soon carry it in to the land. (Above) A seaside holiday can be spoilt by "viscous black oil that becomes sticky in the hot summer sunshine" or arrives as semi-solid sludge. It is difficult to remove from clothes and bodies, and almost impossible from beaches. (Left) A closer view of the oil in its semi-solid condition

oil which is now being washed up on our beaches", and reported quite clearly that oil tankers are a major cause of increased pollution.

What happens is this. When a tanker bringing oil from the Middle East, the Caribbean, or one of the other oil-producing areas pumps out its cargo in a British or continental port a certain residue is left. This is particularly so in the case of Middle East oil that has been pumped aboard in a hot climate like Arabia and discharged on a cold January day in Britain, but there is a residue with all oils, no matter what the temperature. Before the tanker leaves England to return to the oil wells it takes on board 3000 to 6000 tons of sea water as ballast to replace the discharged oil. Below decks, a tanker is divided into about twenty-six compartments, and the water ballast is pumped into the centre compartments whose sides are covered with a film of oil from the cargo. When the tanker is more than fifty miles out to sea on her return voyage, the crew clean the oil film from the compartments by lowering into them a set of whirling jets which eject hot and cold water at high pressure and so wash the compartments clean, and the resultant oily water mixture is pumped overboard.

The ballast tanks are next emptied of their thousands of tons of water, which by this time is thoroughly oil-contaminated, and the process of washing by rotating jets is repeated. The Faulkner Report estimates that between 4500 and 7500 tons of oily water are pumped overboard every time a tanker is cleaned, including twenty to thirty tons of thick, greasy, semi-solid sludge. British tankers "cleaned ship" 1260 times in 1951, so that over 7,500,000 tons of oily water were pumped into the sea by British tankers alone. This is not the whole story for Britain's tanker fleet is only one-fifth of the world's tanker tonnage, and it is easy to estimate how many millions of tons of oily water are being poured into the world's oceans every year.

Perhaps the most serious part of the business is that this oily mixture is virtually indestructible, and no matter how far out to sea it may be discharged, the effect of the tides is to bring some of it eventually to shore. That is why France, Britain, the Low Countries and Scandinavia, all of which are on the western seaboard, have been particularly plagued by pollution.

For the same reason, voluntary agreements not to discharge oily water within fifty miles of the coast, which have been honoured since 1926 by shipowners of a number of countries,

have proved ineffective. There is a general easterly drift in the North Atlantic and the National Institute of Oceanography has calculated that oil discharged only fifty miles from the coast would drift into shore within a few days. Indeed their opinion is that oil discharged as much as 500 miles from the coast will reach land within four to seven weeks, according to the season of the year, and cause pollution.

In 1954, the Institute of Oceanography and R.A.F. Coastal Command are working together to get more information about the distances that tidal drifts will carry oily water. They are operating in a semicircle from the Bay of Biscay nearly to Iceland, and Coastal Command aircraft on training flights will drop a total of some 10,000 envelopes made of plastic at fixed times and places.

These waterproof envelopes contain a stamped addressed postcard asking the finder to answer some simple questions and send it back. A reward of half-a-crown will be given for every completed postcard, so here is a chance for the children to earn some holiday pocket money. The larger the number found and returned, the more accurate will be the Institute's knowledge of tidal drifts and of the distance which oily water can be expected to travel. So keep your eyes open for plastic envelopes when on the beach this summer.

The reason that the problem has become so much greater in recent years lies in the tremendous increase in the world's tanker tonnage. Thirty years ago there were only 5,000,000 tons of tanker shipping in the world. Last year there were more than 22,000,000 tons. Moreover, before World War II, crude oil pumped from the wells was refined near the point of pumping and tankers carried mainly clean oil, so that washing the tanks did not produce an undue quantity of oily water.

Today, the position is quite different. Britain and other European countries have taken to importing crude oil and refining it themselves, thus saving expense and also getting the benefit of the products obtained during the refining process. To do this, millions of pounds have been spent on oil refineries at many places in the United Kingdom such as Heysham, Stanlow (near Manchester), Swansea, Southampton, and the Isle of Grain in Kent. To give an idea of the immensity of the change-over from carrying refined clean oil to crude oil, in 1947 only 2,500,000 tons of crude oil were refined in Britain; while today, seven years later, the refinery capacity is 27,000,000 tons, and imports of refined oil



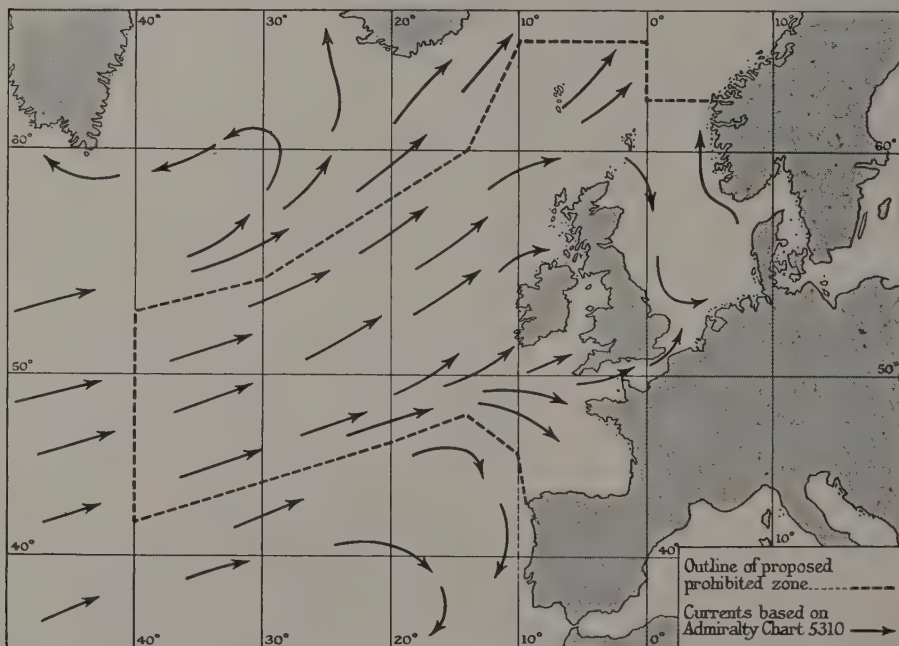
are less than 10 per cent of our total petroleum imports.

The same pattern is emerging on the Continent, where large oil refineries are now handling crude oil at Hamburg, Rotterdam, Antwerp, Dunkirk, Le Havre, St-Nazaire and Bordeaux. Estimated imports of crude oil to the principal near Continental countries were 23,000,000 tons in 1952. Altogether I calculate that in that year, Britain and the Continental countries imported about 46,000,000 tons of crude oil, and discharged about 16,000,000 tons of oily water into near coastal waters in doing so.

Although oil tankers are responsible for much of the pollution of the sea, other ships contribute their share, for most cargo vessels at some time or another fill their empty oil fuel tanks with water ballast in order to maintain stability and trim. The mixture is pumped out when no longer needed and adds to pollution. This problem can be dealt with if ships will install a piece of machinery called a "separator" whose purpose is to separate oil from water. The water can then be pumped

back into the sea and the oil either used again or discharged ashore when the ship reaches port. These separators cost from £330 to £800 according to capacity and although they are far from perfect they can make a considerable contribution towards solving the problem of oil pollution. British shipowners have been fitting them in increasing numbers into their ships, and the Faulkner Report, in an important recommendation, proposes that all new British cargo ships should be fitted with separators. Such a recommendation would need to be enforced by Act of Parliament, but it seems quite possible that British shipowners would not contest such legislation, in view of the assurance given by the General Council of British Shipping in July 1953 that they would cooperate fully in preventing oil pollution, and would adopt all practical measures to do so.

The Admiralty use separators in some ships of the Royal Navy, but in addition they have developed a chemical process for breaking down the mixture of oil and water, whose originator was Mr Killner. This process is



A. J. Thornton

Pending international agreement on steps to prevent oil pollution, the Faulkner Report recommends that United Kingdom registered ships should be prohibited from discharging persistent oils within a prescribed zone. Present knowledge of surface water movements indicates the zone shown above, which is based, by permission, on a chart in the official report of the Faulkner Committee



Central Press Photos Ltd

*To obtain further information, Coastal Command aircraft have begun dropping within the proposed prohibited zone 10,000 waterproof envelopes containing postcards, to be returned to the Institute of Oceanography with details of where and when they were found. The finder will receive 2s. 6d.*

used in H.M.S. *Eagle*, the latest and biggest aircraft-carrier in the Fleet, and in a number of other ships. The oil that is recovered is used again, but the Faulkner Report concludes that the process would not be suitable for merchant ships. This conclusion is disputed by others who have studied the matter, and it is being investigated further by the National Research Development Corporation for it might prove a suitable alternative to using large and cumbersome separators.

The Faulkner Report was decided enough about the proper solution to the problem. "We have come to the conclusion that the aim should be to avoid altogether the discharge of persistent oils into the sea" (Paragraph 4). That is emphatic and clear. What would be needed to make it possible? Apart from fitting separators into cargo ships, the main problem is to deal with the oily water that tankers at present discharge into the sea after cleaning their tanks. This does not seem an insuperable difficulty when it is remembered that oil tankers are divided into a number of compartments. The Faulkner Report recommends that tankers should pump the clean-

ings from the compartments as they are washed, not directly into the sea, but into a central compartment that can be used as a slop tank. When the mixture is allowed to settle, gravity causes the water to sink and the oil to rise to the surface, and experiments carried out by the Government Chemist during tanker voyages showed that a fairly sharp separation takes place as a result of which up to 80 per cent of the water can be discharged into the sea eventually without causing pollution. The problem of dealing with the remaining 20 per cent of oily water is much smaller and the Faulkner Report recommends that it should be retained on board and discharged into suitable shore tanks when the tankers reach port. More research has still to be done to determine how the oily residue is finally to be disposed of on shore. Some commercial firms have begun to operate collection services from the ports with a view to extracting the oil, and some oil-refineries in Britain are ready to buy tank washings and are in fact doing so, with a view to recovering the oil. It seems doubtful whether such a scheme is likely to be a paying proposition, although



by courtesy of Shaw Savill and Albion Co, Ltd

*The compact box-like structure in front of the funnel is all that is needed for separating oil from bilge and ballast water in empty fuel tanks of merchant ships—at small cost compared to damage caused by discharged oil*

it could do something to offset the cost of providing collection services at United Kingdom ports.

But this would not deal with the disposal of the oily water and sludge collected in the slop tanks of tankers which clean their tanks whilst returning to the oilfields. In the Middle East there are few facilities for disposing of the tank washings ashore. The Faulkner Committee therefore approached the major oil companies who have promised to cooperate in providing facilities for receiving the tank washings at the ports in the oilfields that are under their direct control.

Much work remains to be done before we reach the objective of prohibiting the discharge of oil into the sea on a world-wide scale, and as a temporary palliative the Faulkner Report recommends a prohibited zone in the North Atlantic in which British

ships should be prohibited from discharging oily water. The zone runs roughly from 40° W, to Cape Finisterre in the south, and to Trondheim in Norway in the north. The Committee's view was that such a prohibition would, taking into account the tidal drift, lessen the amount of oil reaching the coasts of Britain and the near Continental countries. British shipowners at once accepted this recommendation without waiting for legislation, and their example has been followed by some foreign-owned tanker fleets.

To sum up, the British Government's energetic steps during the last eighteen months have resulted in this country establishing facts that were previously no more than opinions, and propounding solutions that were visionary until government backing was given to them.

We know what needs to be done, and the practical obstacles. But clearly, the seas cannot be rid of this evil unless there is international cooperation. The Minister of Transport has accordingly announced that he has invited forty of the principal maritime nations of the world to meet in London at the end of April 1954, to see if agreement can be reached internationally to prohibit the discharge of oil into the sea, and to consider what steps would be necessary to give practical effect to such an agreement.

We must all hope the Conference will be successful; and if I might give a text for the delegates to consider it would be the wise words of Lord Hurcomb spoken on this subject in October last: "Let us remedy without delay the state of our beaches and of the surface of the sea, which not long ago seemed immune from human damage, now that the way to do so has been so clearly shown. If man makes himself a nuisance to the rest of Nature—of which after all he is part—and continues to befoul his natural surroundings, the consequences will come back upon man, upon his health and his pleasures, and will increasingly impair the best and surest means whereby he is able to sustain and recreate his physical and spiritual energies and well-being."



# Birds of Prey in Britain

by H. N. SOUTHERN

*The author has been engaged for the past sixteen years in research at the Bureau of Animal Population, Oxford, which studies chiefly the numbers and distribution of wild animals. These fields of investigation cover the description of animal communities and their habitats, census work to determine densities, birth and death rates and the share of different factors in controlling them*

Hawks and owls were once regarded as nearly akin, but zoologists now agree that the superficial resemblances of beak and talons are due to convergent evolution and have emerged independently in the two groups. Accordingly modern bird books separate them by interposing the great family of the waders and gulls, leaving the owls near to the most highly developed of all, the perching birds, and sending the hawks down in the evolutionary scale.

The most remarkable adaptation in birds of prey is in the eye, but different specializations have been pursued in the two groups. In both there is binocular vision, but the hawks have specialized in the perception of minute detail, the owls in tremendous light-gathering power. Careful experiments by Dice in America have shown that some owls can find prey in an illumination of less than one-millionth of a foot-candle, which is about equivalent to woodland with an overcast night sky. To achieve this owls have sacrificed colour vision and are sensitive mainly to blue and green light, so that they can be watched at night quite undisturbed by red torchlight, as I have myself proved. Another special feature in owls is the evolution in some species of notably large and asymmetrical ears; it has been shown by Pumphrey that these could serve as a means of audiolocation, of measuring accurately the distance between rustling prey and silent predator.

In Great Britain birds of prey have been harshly treated in the last two centuries: some species we have lost completely and others have been driven into marginal habitats. There are now, however, signs that a movement to protect some of them, which arose primarily from aesthetic reasons, may bring important results by shifting the balance of some wild animal populations back to a condition more favourable to agriculture and forestry.

Let us briefly examine the abundance and distribution of those that remain. Of owls the most numerous and widespread is the tawny, or brown, owl, familiar through its characteristic hooting. It occupies practically all types

of country throughout England and Scotland except open moorland and marsh, but is most dense in deciduous woodland. The long-eared owl primarily inhabits woodland, though often woodland that is cut up into copses and strips; it occurs sparsely and patchily all over Great Britain. The other three species of owl hunt mainly in open country and are less strictly nocturnal. The little owl, introduced in the late 19th century, has spread over most of England's farmlands and heaths and lives chiefly upon insects. The short-eared owl is confined to heathland and marsh all through the country and hunts regularly by day. Finally the barn, or white, owl is fairly common in the south and west of England, but decreases northwards and vanishes just above the Highland line. Like the little owl, it hunts cultivated land, marsh and heath.

The distribution of diurnal birds of prey is much more difficult to summarize because they have suffered more persecution by man. Let us start with four species, whose distribution is probably still "natural". The kestrel and sparrow-hawk are by far the most abundant and occur throughout the British Isles, the kestrel in the open (it is the well-known "windhover"), the sparrow-hawk in the woods. The smaller merlin is confined to the heather moorland of the north and west and could never be called abundant; the hobby, a summer visitor, is rarer still and reaches the upper limit of its range just north of the Thames.

Next we will consider three species whose present distribution is probably far from "natural", though each has increased its range through protection in the last forty years. The peregrine, whose fondness for carrier and homing pigeons has brought it into disfavour, has been driven to the coasts and is now found only sparsely where there are steep cliffs for breeding. The buzzard, a broad-winged, soaring species and the largest British bird of prey that can be called common, was driven back also to the coasts and hill country of the west, but in the last thirty years

has returned eastwards and re-established itself almost to the mid-line of England. The golden eagle, now almost confined to the Scottish Highlands, must originally have had a distribution much like that of the merlin, but it has already recovered some of the ground that it had lost.

Finally there are the three harriers, all birds of the open country with more dash than the buzzard, but wide-winged compared with the falcons (e.g., the hobby or peregrine). The marsh harrier, which has almost vanished from the country with the exception of an odd pair in East Anglia, shows remarkable convergence on characters in that it looks and lives very much like the short-eared owl; it has declined along with its fenland habitat. Both Montagu's and hen harriers are moorland and heath species and they have been reduced to scattered pairs, Montagu's in England, the hen harrier in Scotland. Both would certainly increase again if they were efficiently protected.

Now that we have a rough idea of the status of British birds of prey we can examine, at least in those species which are not too depleted, the way in which their habitat and hunting specializations diminish competition for prey. A knowledge of their food based on large enough figures to show the range of variation according to region, season, year and individual preferences is only available for one or two species, but we have a fairly good qualitative assessment of what each prefers to eat. The main result of such an examination shows that wherever species share a habitat they take different prey. Lack has shown that this holds true for the much richer predator fauna of Europe by analysing the massive figures that Uttendörfer has published. The only exception was caused by cycles in abundance of the short-tailed vole *Microtus arvalis*; at the peak of these cycles, some of which are very spectacular, many species of predators fall to eating voles. In Britain this only occurs on a small scale because our vole *Microtus agrestis* undergoes less violent and widespread fluctuations than the continental species.

These competitive relationships can be most clearly expressed in a table (page 41). From this we can quickly see that whenever two or more species occupy the same habitat their foods tend to be different, so that they avoid directly competing with each other for prey. I shall take up this point again later.

The species so far considered have mostly been reduced in numbers and range; let us now glance briefly at the birds of prey which

we have already nearly or completely lost. Some of these have gone because their habitats have been broken up or because their way of life is no longer possible. Goshawk and honey buzzard are birds of extensive forest lands; they might return in small numbers if they were encouraged in our new plantings. The kite just clings on, but modern sanitation leaves it little to scavenge, and indeed its numbers may have been artificially inflated by our ancestors' habits. The two last species that we have lost are, curiously enough, both fish-eaters—the sea eagle and the osprey—and there seems no obvious reason why they should have disappeared except sheer persecution first by the gun and finally by the egg-collector.

This description of the status of our predaceous birds enables us to see that, although some, e.g. the kite and the marsh harrier, must almost inevitably have decreased to near vanishing point with the spread of civilization, most have declined owing to persecution, and the peculiarly intensive methods of rearing game prevailing during the 19th century must take much of the blame. The competitive relations analysed in the table show that Great Britain could still support a rich fauna of predators, especially now that the big game-estates are being broken up and areas of nature reserve, forest and high farming land are spreading.

We should next consider, therefore, what we know about the position of predators in an animal community and endeavour to forecast what would be the economic results of fostering birds of prey. In doing this we are not forgetting that some rehabilitation is due to them simply as members of the British fauna, which some of us may delight to observe or need for scientific study.

The ecological investigation of animal communities, which tries to elucidate how the absolute and relative numbers of animals in a community are controlled, is a recent development of field biology. Hypotheses are still rather more plentiful than facts, which is partly due to the tremendous task presented by the collection and analysis of the kind of facts needed. Since populations of all animals have enormous capacities for increase (they may multiply by any factor between two and several hundreds each breeding season) and yet remain fairly stable from year to year, ecologists believe that the balancing mortality factors are closely adjusted to the density of a population. When numbers increase, mortality must increase out of proportion, so that an approximate equilibrium is maintained. The





Eric Hosking

*Many British birds of prey were drastically reduced in numbers by intensive game-preserving in the 19th century—the hawks and falcons more than the owls. (Above) The long-eared owl has certainly decreased during the last century, but this may be through competition with the tawny owl*



*The barn-owl hunts mainly in open country, being common in the south and west of England where it can frequently be seen well before dusk floating like a white ghost over meadows and along hedgerows. It feeds almost entirely on rodents and shrews and, nesting often near farms, it accounts for many rats and mice*

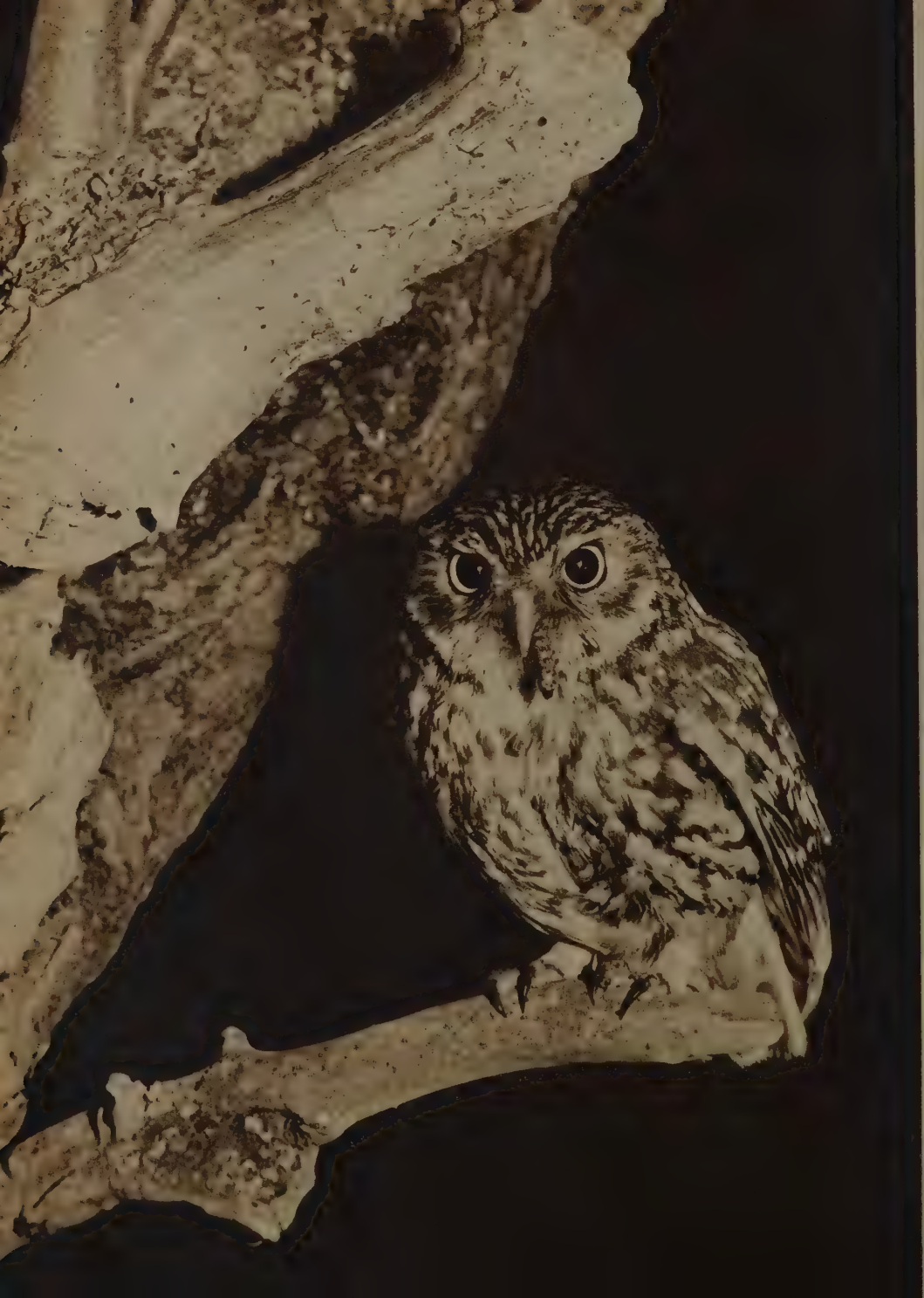
John Markham





Ronald Thompson

*The most familiar of the owls and the one which makes the well-known hooting is the tawny owl. It is widespread in all kinds of country in Britain, but is most numerous in woodlands. Its most remarkable achievement is to have colonized our big towns, and in London it has even been seen roosting in chimney-cowls*







H. Auger

(Opposite) Controversy has raged for years about the little owl, which was introduced into Britain from Spain at the turn of the last century. It has spread and occupied most of the farm- and heath-land of England and, though it is charged with taking song-birds and game-chicks, its main food is insects. (Above) The sparrow-hawk has been persecuted with more reason. While it lives in the kind of woodland which has been typical of game preserves and birds are its chief diet, it remains one of the most plentiful of our diurnal birds of prey and will probably increase still more as game-keeping decreases



H. Auger

*The kestrel is abundant in open country throughout Great Britain and is most conspicuous in its hunting since it hovers with quickly fanning wings searching the ground for small rodents such as the wood-mouse shown here. Occasional birds may become adept at catching game-chicks, but this is unusual*



*The peregrine is our largest falcon and, since it can kill birds up to the size of a grouse, it has been driven back to the higher cliffs of our coastline for breeding. Now that it is rare, collectors harry it for its eggs and falconers for its chicks. It would quickly recover if properly protected*

Eric Hosking







Hugh G. Wagstaff

*The buzzard is an example of what could happen to many of our rarer birds of prey, if encouraged. Being large and rather slow it cannot often have threatened game-birds, yet persecution made it scarce. A more reasonable attitude has allowed it to become common again in the west of England*

agents that can act in this "density-dependent" way are food, predators (and parasites) and disease, and their action is frequently extended or overlaid by competition between and within species for living space, shelter and other needs characteristic for each kind of animal.

No ecologist expects that he can go out into the field and demonstrate in a short study the operation of these processes in Nature because they are overlaid (a) by chance occurrences such as deaths from hard weather or floods which are unrelated to density; (b) by the smoothing effect of cross-connexions between the food chains, e.g. if a predator's food diminishes, it may just eat something else; and (c) possibly by some method of spacing

out individuals, as when an animal occupies and defends a given territory, since this may apparently hold a population at a lower level than that indicated by the available food. Nevertheless it is clearly of paramount importance to discover whether certain animals are being controlled by, e.g., food or predators; and field work on these problems is going on at several British research institutes now. Small rodents are a case in point. There seems so far little evidence that the third possible controlling factor, disease, is important in vertebrate animals. If then small rodents, like some of our voles, multiply to the limit of their food before being reduced by starvation, the effect on the vegetation will be pretty devastating; in fact on the continent enor-

### HABITAT DISTRIBUTION AND FOOD OF THE COMMONER BRITISH BIRDS OF PREY

<i>Species</i>	<i>Woodland</i>	<i>Cultivated land</i>	<i>Moorland and marsh</i>
Tawny owl	1. Wood mice and bank voles 2. Earthworms	1. Wood mice, bank voles and short-tailed voles 2. Earthworms	—
Long-eared owl	1. Wood mice and bank voles 2. Small birds	1. Wood mice, bank voles and short-tailed voles 2. Small birds	—
Barn owl	—	1. Shrews 2. Small rodents, especially short-tailed voles	Sparsely distributed, food as in cultivated land
Short-eared owl	—	—	1. Small rodents, especially short-tailed voles
Kestrel	—	1. Small rodents, especially short-tailed voles 2. Small birds	1. Small rodents, especially short-tailed voles
Sparrow-hawk	1. Small birds almost entirely	—	—
Merlin	—	—	1. Small birds almost entirely
Hobby	1. Insects 2. Small birds	—	1. Insects 2. Small birds
Buzzard	—	1. Rabbits 2. Short-tailed voles	1. Rabbits 2. Short-tailed voles

*Note.* The hobby frequents only moorland which has some scattered trees and so does not overlap the merlin, which is a bird of bare moorlands.

mous crop losses are suffered periodically through the swarming of *Microtus arvalis*. But if these rodents are controlled by predators then vegetation will suffer much less.

At this point we may perhaps break away from generalities and discuss one pertinent problem. Leaving aside damage to agriculture, it is clear that silviculture in this country labours under an enormous handicap. Hardly anywhere are British forests regenerating naturally. Seed must be collected and planted in nurseries and seedlings at the appropriate stage transferred to carefully prepared ground, which has been laboriously surrounded by wire netting. The multitudes of our rodents—wood mice, voles, rabbits—are responsible for this. Now our present mature forests could not have grown up under such conditions and it seems likely that the large-scale experiment performed for us by the big shooting estates during the last century has shown the results of reducing the birds and beasts of prey to a low level. Owing to the sometimes unexpected repercussions of disturbing one link in an animal community, we cannot yet regard this as simple cause and effect, but some more certain evidence is gradually accumulating.

I would like to quote here some tentative results from my own investigations. In woodland the tawny owl, if protected, reaches the greatest density known for any British bird of prey. Over eight years an estate of 1000 acres has contained just over twenty pairs. Since each bird takes an average of two small rodents a day, among other things, and since during six months of the year these demands can be doubled on account of chicks to be fed, the whole population is eating some 43,000 mice and voles per year without counting other prey like rabbits, moles and shrews. The size of this figure is, of course, not fully significant until we also know the numbers and turnover of the mice and voles, and I am still working upon this aspect. Even if we cannot be satisfied yet that the numbers of the small rodents are predator-controlled, it is difficult to believe that the effect of such a toll is negligible. Visible increase in the number of seedling trees is obscured by rabbits and grey squirrels and one is led to wonder whether these species also would not yield to increased predation. Carnivorous mammals, such as stoats, polecats and pine martens, would be more relevant here than birds of prey, but there would be indirect benefits from an increase of sparrow-hawks and an introduction of goshawks. The former preys on small passerine birds, which do much to diminish the

seed crops of, e.g., beech; the latter on jays and wood-pigeons, which eat the seed crop of the oak.

On the whole there seems to be a strong case for some deliberate attempts to increase predators in our woods and farmlands. Probably this could be easily achieved. Here we may refer back to the table of competitive relationships. Superficially we might suppose that an increase in one species would only lead to the decrease of another, but the table shows that in each habitat an increase of any of the species shown would only increase the drain on its special prey, which other predators take only secondarily. (Some apparent exceptions, such as the short-eared owl and kestrel on moorland and marsh and the tawny and long-eared owls in woodland, are due to geographical differences in their distribution, which are not easy to include in the table.) Furthermore there are many species, such as the buzzard, the goshawk and the harriers, which now occupy only a fraction of their available habitat.

Thus, while intensive work proceeds upon the fundamental principles of predator-prey balance, extensive experiments might well be tried first in nature reserves and national and forest parks to see whether fostering predators will reduce the populations of the rodents. The history of the buzzard, which from being thrust back into the mountainous western fringe has so far recovered that it now breeds as far east as Oxfordshire and Surrey, shows what can be done in this way merely by easing persecution. Actual encouragement with carefully contrived introductions would speed up this process considerably.

Finally, supposing that experiments of this kind showed results promising enough to encourage a country-wide policy of promoting birds of prey, we must consider what effect this might have on the various classes of land-user in Great Britain. First and foremost comes the farmer. Now that an increasing number of farmers own their own land and are achieving higher standards of agricultural productivity, good crops are generally thought more desirable than good days with the rabbits. The farmer certainly stands to gain from an increase of predators with the single exception of the fox, which paradoxically was protected and fostered by the big landowners. The tremendous decrease of the rabbit in Australia owing to the spread of the introduced disease of myxomatosis has already increased the value of the wool-clip by many million pounds, and equally startling increased yields would probably come from





John Markham

*A family of young barn owls like the one illustrated needs between fifteen and twenty mice or voles a day. The author contends that, since the vast numbers of these small animals are harmful to agriculture and forestry, the owls and hawks which eat them deserve our most vigorous protection*

British farms, especially in the west, if the rabbit were brought low in numbers.

The second most important land-user now is probably the forester and the benefits which he would receive from a decrease of rodents have already been outlined.

Lastly we must consider the game interests. Nowadays it is impossible anyway to secure gigantic game-bags because there simply is not the cheap labour available for game-keeping with which alone the estates of the last century produced their astonishing results. But there is no reason whatever why good crops of game-birds cannot be produced with high densities of predators. On one big estate, heavily kept and so "vermin-free", all the partridges hatched their first clutches and a downpour killed most of the chicks at the most vulnerable age. On another estate nests

were lost to "vermin" and some of the partridges laid again. As a result the hatchings were staggered and a good crop of chicks survived the downpour. With smaller stocks of game-birds bred in wild conditions the sport is usually superior, even though the bag records are not so swollen; furthermore birds of prey act as agents of natural selection to weed out the poorer stock.

To sum up, what we really need to do is to recast our ideas about what are "vermin". Now the great estates are going our main concerns should be the good health of the land and the preservation of as much of our fauna in as near its original condition as circumstances permit. This means among many other things that vanishing or lost birds of prey should be encouraged to re-enter into their kingdoms.

# Kielder Forest

by SIR STEPHEN TALLENTS, K.C.M.G., C.B., C.B.E.



topography, except one, by F. Sturgesburgs

*Few people not directly concerned with such questions appreciate how important is the Forestry Commission's contribution to our economy or how extensive are the areas to which its operations apply. The Commission now owns 1,909,000 acres of which 786,000—an area approximately equal to that of Gloucestershire—are already planted. Kielder is the largest single forest in Britain*

"THE Duke tells me his people in Keeldar were all quite wild the first time his father went up to shoot there. The women had no other dress than a bed-gown and petticoat. The men were savage and could hardly be brought to rise from the heath, either from sullenness or fear. They sung a wild tune, the burden of which was 'Ourina, ourina, ourina.' The females sung, the men danced round, and at a certain part of the tune they drew their dirks, which they always wore."

These words are taken from Sir Walter Scott's Journal and were written on October 7, 1827, when Scott was staying with the Duke of Northumberland at Alnwick. Kielder—so its name is spelt nowadays—lies to the south-west of Cheviot at the head of the valley of the North Tyne, close to Cumberland and also to the Border. Nearly fifty years before Scott wrote, the Duke's father had built himself there a pseudo-mediaeval castle as a shooting box. Last September, nearly 180

years later, driving some thirty miles out of Hexham up the Tyne valley, I visited Kielder and found in the valley very different people, living in homes and employed in occupations very different from those which the old Duke's father had found on his shoot.

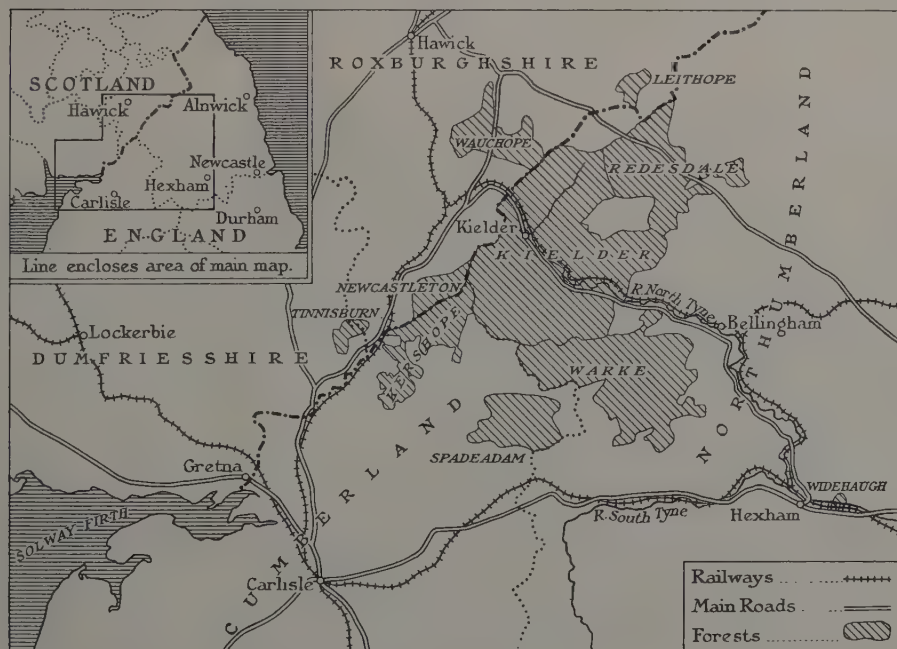
Today the castle is a local headquarters of the Forestry Commission and the hillsides about it are the scene of the biggest of all the afforestation schemes in which the Commission is engaged. For Kielder is the largest unit in a group of nine forests, five of them to the south and four to the north of the Border. It embraces 73,000 acres, of which 42,000 are assigned to forestry. The balance is either reserved for agriculture or as grazing for sheep or is left unplanted as being above the height at which trees will prosper. This forest group embodies the imagination and the plans of a great Australian forester, Lord Robinson of Kielder. On the day of my visit, far up the Whickhope Burn, the finishing

touches were being put to an austere and simple cairn dedicated to Roy Robinson's memory. That high and desolate place had been chosen for the breadth of its outlook over a forest in which he had seen planted and personally felled the first tree, over ground on which, after his death in Canada during the Commonwealth Forestry Conference of 1952, his ashes by his own desire had been scattered.

A word first about the background against which this great project must be viewed. Between 1850 and 1913 Britain's consumption of timber—about 90 per cent of it a consumption of softwoods—increased fivefold. The German submarine campaign in World War I reduced our stocks to a dangerous level and threw into stark relief both our shortage of home-grown softwoods and our lack of any national policy for our woodlands. The Forestry Commission was created in 1919 to remedy both these deficiencies. But, though it pursued from the first an active and enlightened policy, trees are not grown in either a day or a decade. Between the wars Britain's consumption of timber tended to increase still further; and, in the years immediately preceding World War II, all but 4 per cent of the country's needs were filled by importations from abroad. During that war a ruthless stripping of our

woods temporarily raised the home-grown share of our timber consumption from 4 to 65 per cent. In 1943 the Forestry Commission prepared and laid before Parliament a programme designed to secure over fifty years, by a combination of state and private plantings, 5,000,000 acres of "effective forest" and thus to raise Britain's contribution to her own timber needs to 35 per cent. The group of forests of which Kielder forms part is the Commission's greatest single effort towards the fulfilment of that programme.

The Forestry Commission is sometimes accused of neglecting in favour of its great conifer plantations the claims of our better-loved native hardwood trees—oak and ash, beech and elm. Two inescapable facts here determine its policy. Britain's preponderant consumption of softwoods requires that not more than, say, 10 per cent of hardwoods should be allowed for in the planting programme of a body whose prime duty it is to look to Britain's industrial needs; and the claims of agriculture for food production, on the soils which hardwood trees require for their proper growth, forbid the planting of hardwood trees by such a body on a large scale. Anyone who has seen and admired in their maturity the softwood forests of France and Germany, of







*Fred C. Wood (Studios) Ltd*

*(Above) The earliest stage in the creation of a forest is the planting out of millions of young trees. The seventy acres of Widehaugh, near Hexham, constitute the largest nursery in the north of England.*

*(Below) A special plough clears a drainage channel and lays out turves in which young trees are planted*





*Spruce takes very well to peaty soil, which is unsuitable for other crops. (Above) Sitka spruce set out with five feet between the trees, which have just been transplanted after they have spent their first four years in the nursery. (Below) Four years later—some trees are now about five feet high*







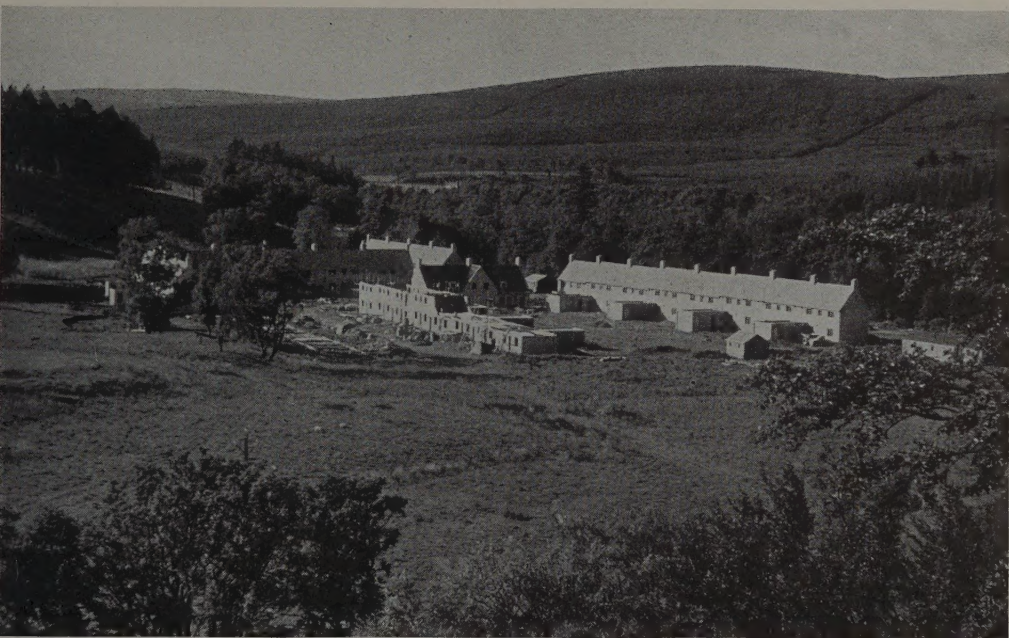
*Part of Kielder Forest. In the foreground is Norway spruce, roughly twelve years old. On the right, beyond the railway that runs up the valley of the North Tyne river, are some older trees. But forestry is not just a matter of growing trees: workers, roads and drains are also important*

Scandinavia and the Baltic countries of Latvia and Lithuania, will agree, without surrendering his love of English oak and elm, that conifer woodlands can yield to the traveller both a fine sight and agreeable surroundings. There are Latvian refugees, it may incidentally be noted, doing valuable work in the Kielder headquarters.

Research has shown that much of the land on which Kielder Forest grows was long ago, after the last Ice Age, an area of rough forest growth: of birch and alder, oak and scrub. Low down in the valleys, the Forestry Commission has noted, primroses, wood-anemones and wood-sorrel are evidence of the existence of a *primaeval* forest. This forest land was starkly cleared, as sheep-farming spread up the valleys from the south. Now the trees are coming back into their own. The oldest trees

I saw at close quarters during my visit to Kielder were stands of twenty-five-year-old spruce, already some fifty feet in height, among which had already begun the thinning which, some fifty years hence, will have reduced their numbers to about 240 to the acre. Thinnings, which I also saw, were mostly going for pit-props in the mines of Northumberland and Durham; but some of them were destined to make fish boxes in Lancashire and others paper pulp in Kent. The youngest trees I saw were infants brought the previous spring from the great Widehaugh nursery at Hexham. They will there have spent one year, or possibly two, as seedlings, and a further year as "transplants". These babies are planted 2000 to the acre on ploughed land. The ploughshare, as it advances, lays aside a fold of top-soil, and in turves cut from that





(Above) *The new village at Kielder gives forestry workers amenities not normally found in such remote border villages. (Below) The need for good roads for the extraction of timber is evident in a district with a high rainfall and soft soil, since badly made roads quickly become impassable*







*The trees themselves need much maintenance. Drainage helps to keep up the rate of growth and ensures stability in the crop, for waterlogged soil kills the roots, which both take in nutrition and act as supports. The trimming of side branches facilitates access, and reduces knots and risk of fire*





*Fire is a constant danger. (Above) Proceeding along a fire-break, this party carries beaters for extinguishing blazing moor grass which, when dry, is exceedingly inflammable. Water is also used when available but is often scarce on the hills. (Below) Some of the destruction wrought by high winds*





fold with rutting spade and drag the little trees are bedded. This preparation and draining of the land by ploughing is a feature of modern forestry on the large scale. Ploughing, it seems, for that purpose is recorded as long ago as 1870 in Yorkshire and even eighty years earlier in Ireland. But in each country the difficulty and cost of ploughing with horses defeated the pioneers of a method which the coming of the tractor has now made economic.

There are minor groups of larch and Douglas fir here and there in the forest, and in places a sprinkling of decorative hardwood trees such as rowan, oak and maple. But in the main four species of tree have gone to the now nearly completed planting of Kielder Forest—on the lower ground the Sitka spruce, with its dark bark and blue and green foliage and the reddish-barked Norway spruce, which any child would recognize as a Christmas tree; in higher and more exposed places, up to heights of 1250 feet, the Scots pine, a native of Britain, and the lodgepole pine, a native of Canada.

The human element is an essential factor, present and future, in the planting and establishment of a forest. The plans for Kielder envisage the construction of five villages, the design of which has been entrusted to Mr Thomas Sharp, the well-known planning consultant. I saw the first of them in partially completed form at Kielder itself—comely white houses with internal layouts carefully thought out to meet the exigencies of winter. It is hoped within each of these villages to create, with farm workers from the countryside sharing the social amenities, a community of forestry workers. Each village is to have its church, shops, inn and village hall serving the entire neighbourhood. Kielder is foreseen, when completed, as a village of 250 houses with a population between 850 and 1000. To look further ahead to years when the forest is fully productive, the time should come when sawmilling and other industries dependent upon forest products may be expected to develop locally. Meantime it was interesting to find that Bellingham, some thirteen miles from Kielder, which had once relied on its now disused ironstone quarries, already regarded the new forest as its most important single source of employment.

No-one could visit Kielder, even as briefly as I did, without picking up much curious information, and getting a glimpse of both its present and its future problems. I did not know, for example, that heather has special

significance for the forester. Young trees appear not to thrive on heather sites unless there has been ploughing before planting. A visitor from the south expects to find rabbits and grey squirrels among the forester's principal enemies. There are red squirrels at Kielder, but no grey. There was supposed to be one rabbit only in all the forest, with its headquarters at Emmethaugh. If that be so, I was fortunate in getting a glimpse of the solitary creature. Sheep, I found, were the main four-footed enemy. I saw a garden, cherished by the courteous officer of the Forestry Commission who acted as my guide, which had been devastated a week or so before by sheep that had burst through its fence.

The chief anxiety of the forest is peril of fire. From mid-February to mid-June, when drying winds are apt to prevail, is the danger season; and the danger is particularly serious when trees are young and canopied almost to the ground, before they have been naturally or artificially thinned. Six years ago nearly 700 acres were destroyed at Kielder by a fire which at its height was advancing over fifteen acres a minute. The visitor is reminded of the peril at every point. At the castle he will see the fire-watcher's tower, from which a maroon gives the signal of an outbreak. In the fire station he will find, besides engine and tank carrier, hand pumps, field telephones and indicator boards—"This way to the Fire". On the road warning notices confront him, and in the forest he will be shown emergency water tanks and be told of many other precautions. Drainage is another problem. So is transport. The bed of the North Tyne has in places been scoured—and scarred—by the dredging of stones to make roads through the forest. This problem will become more serious when in future years not thinnings only but heavy timber has to be removed.

Those who visit Kielder will not only learn to appreciate some of the forester's problems. They will find themselves in a wild, beautiful and historic stretch of our English uplands. Let them be careful with their disposal of litter and scrupulous in their handling of matches and cigarette ends. Those who cannot visit it but would know more of it than a short article can tell will find its story admirably set out in a shilling illustrated booklet entitled *Kielder* which the Stationery Office has published for the Commission. Whether or not they can visit Kielder, let all who are concerned with the future of our new British forests wish Kielder well.